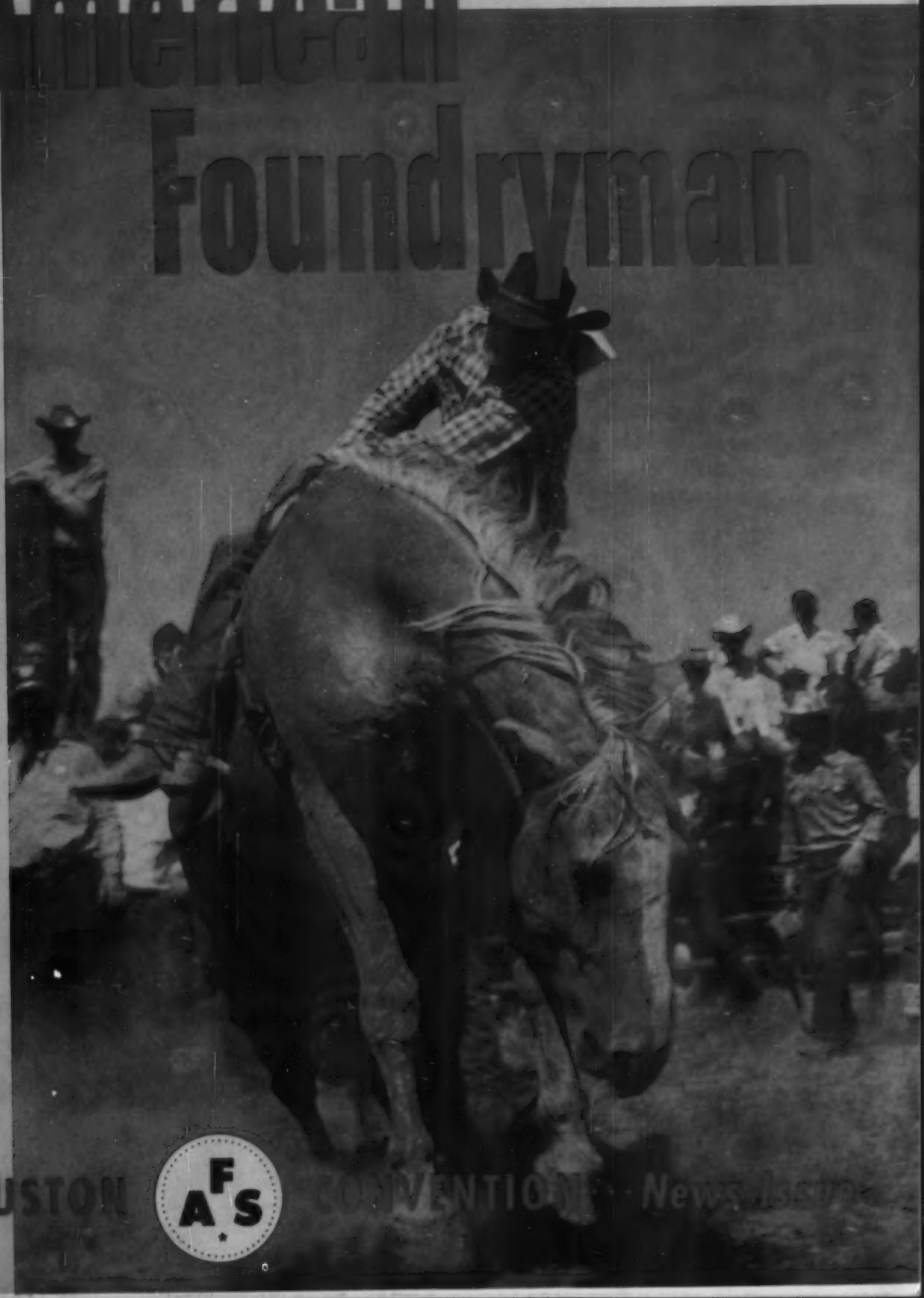
American Foundryman

JUNE, 1955



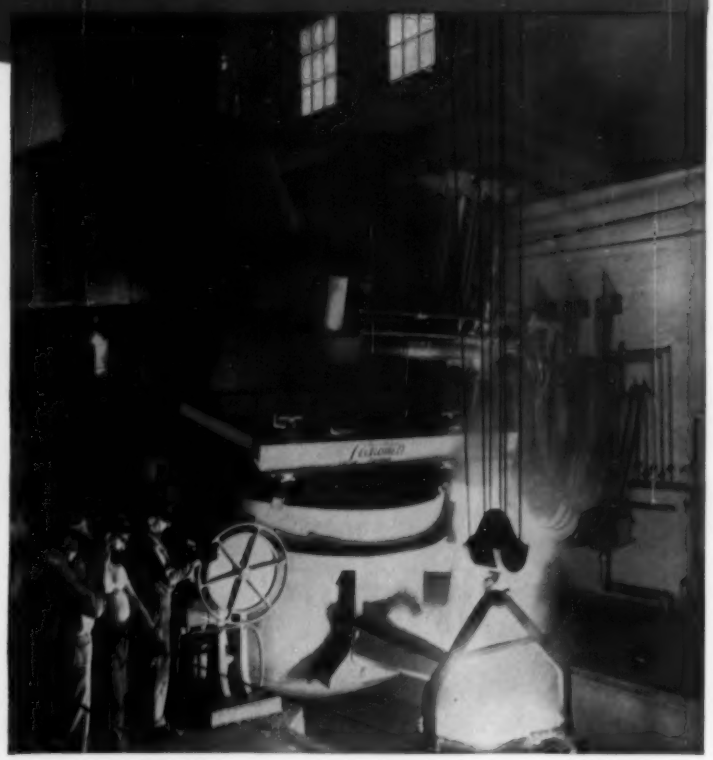
HOUSTON CONVENTION News Issue

AFS

if you judge a furnace on performance...

For 34 years Empire Steel Castings, Inc., has depended on this Lectromelt Furnace. Rated at 1½ tons, it consistently pours 2½ to 3-ton heats.

Top charging of their new 5-ton Lectromelt Furnace requires only 3 to 5 minutes, compared with 25 to 35 minutes for door-charging.



A rugged, 34-year-old Lectromelt* Furnace still works full time at Empire Steel Castings, Inc., Reading, Pa. Empire says, "It's as good as the day it started. Better, in fact, because we found we could pour additional power to it, so we get heats out faster than we first dared to."

On the basis of the performance and reliability of Empire's old furnace, they recently bought a new 5-ton, top-charging Lectromelt. Now they get much closer temperature and chemical control. And new, pin-point analysis control enables them to duplicate uniformity and high grade of molten metal in lot after lot of stainless.

Lectromelt Furnaces will boost your performance record and add to the quality of your metal. Write for Catalog #9 describing them in detail. Pittsburgh Lectromelt Furnace Corporation, 316 32nd Street, Pittsburgh, Pennsylvania.

Manufactured in... GERMANY: Friedrich Kocks GMBH, Dusseldorf... ENGLAND: Birlec, Ltd., Birmingham ... FRANCE: Stein et Roubaix, Paris ... BELGIUM: S. A. Belge Stein et Roubaix, Bressoux-Liege ... SPAIN: General Electrica Espanola, Bilbao ... ITALY: Forni Stein, Genoa. JAPAN: Daido Steel Co., Ltd., Nagoya

*REG. T. M. U. S. PAT. OFF.

WHEN YOU MELT... MOORE RAPID *Lectromelt*

For more facts, circle No. 551 on postage-free Reader Service card on p. 17 or 18

HERE'S ALL YOU NEED

If it's easier, better sand control you're after—here's the answer! These three materials, added in varying amounts to sand (dry or in slurry), will give you *close control* over green and dry strength and carbon content, and also provide GREATER FLOWABILITY and LESS LUMPY SHAKEOUT!

GREEN BOND Bentonite excels in developing and controlling green and dry strength. Its medium to low viscosity cuts down on mulling time and permits slurry users to add more bentonite per gallon of slurry, without strain on the pumping system. CROWN HILL Seacoal is exceptionally low in sulphur content, which means your castings will have more easily machined surfaces. Federal SAND STABILIZER improves the flowability of sand and eliminates lumps in sand shakeout. It burns out faster than any other facing material. Since it has a very low ash content and has no deteriorating effect on sand, you can re-use your molding sand *safely.*

And this is important—these advantages, plus many others, are yours at low cost. For these sand additives will actually cost you *less than $1.00 per ton of castings produced!* To learn more about them, write for your copy of *"Tailor-Made Molding Sands".*

FEDERAL

The FEDERAL FOUNDRY SUPPLY Company

4600 EAST 71st STREET, CLEVELAND 5, OHIO

CROWN HILL, W. VA. • CHICAGO • DETROIT • MILWAUKEE • RICHMOND, VA. • ST. LOUIS • CHATTANOOGA • NEW YORK • UPTON, WYO.

"Facing" Facts

FROM STEVENS FACING DEPARTMENT

FOUR TIMES AROUND THE INDIANAPOLIS SPEEDWAY

IF DRUMS OF STEVENS LIQUID PARTING THAT HAVE BEEN USED BY FOUNDRIES EVERYWHERE WERE PLACED SIDE-BY-SIDE THEY WOULD STRETCH MORE THAN FOUR TIMES AROUND THE TWO AND ONE-HALF MILE INDIANAPOLIS SPEEDWAY.

NO DUST FOR MOLDERS TO BREATHE

MOLDERS USING STEVENS LIQUID PARTING SAVE TIME IN DUSTING DRY PARTING ON EVERY MOLD. IT ELIMINATES THE DUSTY AIR AROUND MOLDERS... KEEPS BREATHING ZONE CLEAN AND FRESH.

GET 40 MOLDS FROM ONE APPLICATION

ONE LARGE MIDWEST FOUNDRY THAT AVERAGES 1,200 TONS OF CASTINGS PER MONTH REPORTS UP TO 40 MOLDS FROM ONE APPLICATION OF STEVENS LIQUID PARTING.

LARGEST SELLING LIQUID PARTING IN THE WORLD

HAS BECOME PHENOMENAL "BEST-SELLER" BECAUSE OF IT'S GREAT ECONOMY AND MANY VARIED USES.

FOR ECONOMY YOU CAN'T BEAT . . STEVENS LIQUID PARTING

In the Stevens files we have many testimonials from foundries which state they have made up to 60 molds from a single application of Stevens Liquid Parting. We have hundreds of reports of 25 to 50 molds for a single application. That's positive proof of its economy. And it is one of the important reasons why Stevens Liquid Parting is the largest selling liquid parting in the world today.

Consider these additional features: Patterns are left clean, with no adhering sand . . . Molds always give smooth castings because sand separates cleanly . . . Molders save time and increase production since, unlike dry partings, it is not necessary to shake parting on the pattern for each mold . . . It eliminates any need for heating patterns or plates . . . There is no parting dust in the molder's breathing zone.

If you have never tried this great foundry item be sure to make an early test in your own plant soon. Call your Stevens Sales Representative or write direct to Frederic B. Stevens, Inc., Detroit 16, Michigan.

WHAT USERS SAY:

WE TRIED MANY OTHER BRANDS

"After trying several other liquid partings, we tried the Stevens product and must admit its superiority to all others."

NO STICKING IN CORE BOXES

"Since using Stevens Liquid Parting there is no sticking in the core boxes, and they have taken on a 'burnished' appearance. Results are very satisfactory."

SOLVED OUR DIFFICULT CASTING JOB

"Stevens Liquid Parting enabled us to solve a difficult casting job of fins for an air cooled internal combustion engine."

COST IS NEGLIGIBLE

"The cost of Stevens Liquid Parting is negligible. On 625 tons of castings our parting costs were $60.00 or about 10c per ton of casting."

BRANCHES: BUFFALO • CLEVELAND • INDIANAPOLIS • NEW HAVEN

Exclusive Sales Agents for Sutter Foundry Equipment in the United States. See the Sutter Products Company ads on page 35-36.

FOUNDRY FACINGS | GRINDING OPERATIONS | BLAST FINISHING | BARREL TUMBLING | METAL CLEANING | POLISHING & BUFFING | AUTOMATIC FINISHING | AUTOMATIC PLATING | METAL RECLAMATION

Metal Finishing equipment and supplies from castings or stampings to finished product

FREDERIC B. STEVENS INCORPORATED

EVERYTHING FOR A FOUNDRY

For more facts, circle No. 529 on postage-free Reader Service card on p. 17 or 18

American Foundryman

Volume 27 *June 1955* *Number 6*

Published by American Foundrymen's Society

AFS Headquarters
Golf & Wolf Roads
Des Plaines, Ill.
VAnderbilt 4-0181

Wm. W. Maloney
General Manager

American Foundryman

H. F. Scobie, *Editor*
J. M. Eckert, *Advertising Manager*
G. J. Minogue, *Production*

Contributing Editors

H. J. Heine, *Technical*
W. N. Davis, *Safety & Hygiene & Air Pollution Control*
A. B. Sinnett, *Education*

Advertising Representatives

CENTRAL—Wm. I. Englehart
District Manager
Detroit-Warren Building
14805 Detroit Ave., Cleveland
BOulevard 2-2433

MIDWESTERN—Dwight Early & Sons
100 N. LaSalle St., Chicago
CEntral 6-2184

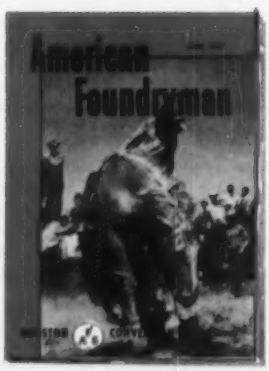
EASTERN—Robert B. Weston
District Manager
6 E. 39th St., New York
MUrray Hill 5-9450

In This Issue . . .

Tips Trends & Techniques	5
Talk of the Industry	43
1955 Convention News	46
Five Ways to Desulphurize / D. E. Parsons and S. L. Gertsman	60
1955 Apprentice Contest Winners	66
Non-Ferrous Founders Hold Annual Meeting / H. F. Scobie	68
Quick Test for Melt Quality / H. Rosenthal and S. Lipson	69
Do's and Don'ts of Fan Connections / W. E. Tracy	74
Measuring Molding Sand Blowability / D. M. Murray	78
Designing Cast-Weld Construction / G. L. Gibson	82
Titanium Production Techniques / D. I. Sinizer and C. M. Adams, Jr.	85
Duplexed Malleable Control / L. E. Emery	90
Foundry Facts—Quality Control / Kenneth MacKay Smith	99

Regular Departments . . .

Products and Processes	10
Free Foundry Information	17
Foundrymen in the News	32
Foundry Trade News	102
Future Meetings and Exhibits	104
Chapter News	110
Casting Through the Ages	123
Chapter Meetings	126
Rammed Up and Poured	126
Classified Advertising	128
Obituaries	129
Advertisers and Their Agencies	130



Cover photo by
Underwood and Underwood

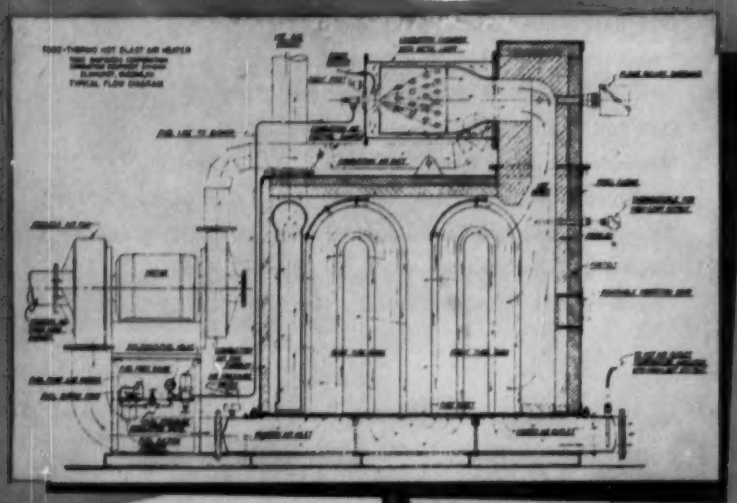
AMERICAN FOUNDRYMAN is indexed by Engineering Index, Inc., 29 West 39th St., New York 18, N. Y. and is microfilmed by University Microfilms, 313 N. First St., Ann Arbor, Mich.

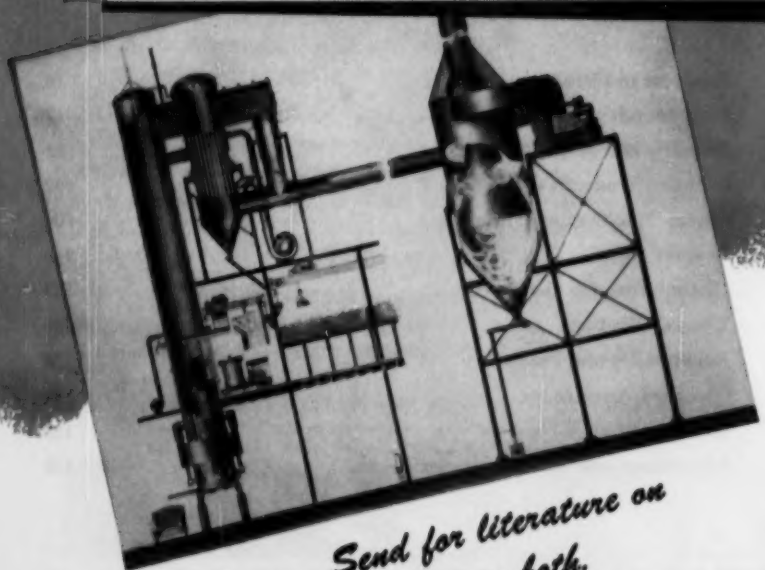
Published monthly by the American Foundrymen's Society, Inc., Golf & Wolf Roads, Des Plaines, Ill. Subscription price in the U.S., Canada and Mexico $3.00 per year; elsewhere, $6.00. Single Copies 50c. May and June issues $1.00. Entered as Second Class Matter under Act of March 3, 1879, at the Post Office, Chicago. Additional entry at Des Plaines, Ill.

NOW

a full range of HOT BLAST service

. . . MADE POSSIBLE WITH OUR APPOINTMENT AS EXCLUSIVE AGENTS FOR TODD-THERMO HOT BLAST HEATERS IN THE FOUNDRY INDUSTRY





TODD NEW YORK U.S.A.

Direct-Fired

TODD-THERMO Hot Blast Heater, utilizing gas or oil for fuel, employs a floating type exchanger section, composed of two or more banks of "U" or hairpin staggered tubes. Front bank of tubes, at which point the severe (highest) inlet temperature is encountered, is made of especially selected alloy metals.

Compactness and Efficiency

are reflected in TODD-THERMO Hot Blast Heaters which, in a few minutes, will heat pure uncontaminated air, of any foundry required volume, up to 1000° F., at small operational cost, with practically no maintenance.

Grindle

. . . Recuperative

GRINDLE RECUPERATIVE Hot Blast, utilizing waste gases from the cupola, is normally used in conjunction with dust collecting equipment. The cupola is capped, converting the upper section of stack into a combustion chamber in which the waste gases are ignited.

Resultant heat is drawn vertically downward through a single-pass heat exchanger. Much of the coarse particulate matter drops out in this unit and is collected in the bottom cone. Waste gases then pass on to the selected type of collector . . . electrostatic precipitator, baghouse, or Vortex.

Send for literature on either, or both, today!

EITHER TODD OR GRINDLE ENGINEERS ARE AVAILABLE FOR CONSULTATION WITHOUT OBLIGATION.

GRINDLE CORPORATION

15403 PARK AVE., HARVEY, ILLINOIS

Tips, Trends & Techniques

Foundry Technology in Brief

Processes, materials, and equipment combined with educational programs and management techniques to give this year's convention of the American Foundrymen's Society broad coverage of foundry problems and their solutions. First half of the Convention News Story starts on p. 48.

Why Desulphurize Gray Iron?

So you can: Use more gray iron scrap . . . Save manganese . . . Meet strict specifications . . . Make nodular iron. For five ways to desulphurize in the ladle and the efficiencies of the methods see page 80.

Makes Metal Blow Bubbles

Quick test for melt quality of non-ferrous alloys measures gas content. Previously limited to an estimate, the vacuum solidification test has been put on a quantitative basis. Apparatus is simple, test is over in a moment. Page 69.

Your Exhaust Fans Hooked Up Right?

It's easy to connect fans to exhaust systems correctly, so why do it wrong? Poor inlet connections are bad enough, but poor outlet connections reduce air delivery too. "Do's" and "Don't's" start on page 74.

Rating Molding Sand Blowability

Now they're blowing molds and blowability of the relatively gummy sands is a problem. No single property indicates how well a molding sand will blow, but a series of tests and a little interpretation will tell. Story starting on page 78 describes method used by shop with mechanized blow-squeeze molding unit.

Foresight Welding

Hindsight welding takes care of overlooked and forgotten factors, but foresight welding is done according to plan. Idea is to split up complicated castings so they can be cast sound economically, then weld the sections together. Page 82.

How to Make Titanium Behave

Major problem of titanium melters is to keep the highly reactive metal from alloying with carbon, nitrogen, oxygen, or hydrogen, as well as with the commonly used refractories and mold materials. Furnace for high-quality titanium castings is described on page 85.

Melting Control Starts with Raw Materials

To make the most of duplex melting for malleable: Purchase raw materials on specification . . . Keep graphitic carbon bearing materials under control . . . Use sound cupola practice to keep silicon and manganese loss low for better annealability . . . Control castability by measuring temperatures . . . Use proper metallurgical coal for furnace atmosphere control . . . Watch metal fluidity as an indicator of melting conditions . . . Desulphurize to refine metal, control sulphur, minimize non-metallic inclusions. Page 90.

Speeds Quality Control Calculations

It takes less than 60 seconds to make quality control calculations that normally require 15 to 20 minutes when you use a slide rule and a graph. You'll have to provide your own slide rule but the graph and how to use it will be found on pages 99-100.

Something Old, Something New

Something borrowed, and no one will be blue when MODERN CASTINGS and *American Foundryman* makes its debut in July. There'll be many familiar sections and types of stories plus some new ones, a big bonus section that doubles the normal feature content, a new name, and a new size. We're borrowing the size from the popular, easy-to-read, square-page, king-size magazines. Features coming up include: "How to Bake Cores Without Heat" . . . "Does Your Insurance Cover It?" . . . "Smooth that Alligator Skin!" . . . "Is Oil Quenching Best for Pearlitic?" . . . "Let's Make Basic Steel" . . . "Casting High Quality Magnesium" . . . and the *special bonus section*, "Environment in the Foundry."

● MADE BIGGER

● MADE BIGGER

● MADE BIGGER

● MADE BIGGER

made BIGGER

to Serve the Needs of a BIG MARKET

It takes a lot of "know how" to provide information for the $6,000,000,000 Castings Market . . . that's why this Industry-Owned Magazine is being expanded in size, scope and market influence, beginning with the July 1955 issue.

Industry Progress has dictated the need for more reliable technical-practical information, expanded news coverage, and adequate sources of equipment and materials supply—the new MODERN CASTINGS and American Foundryman will fill this requirement for the Castings Industry.

"King Size" and changed format will mean a larger page area . . . more material . . . clearer illustrations . . . editorial matter adjacent to every advertisement . . . for visual ease and intensified reader interest.

Coordinated Coverage of all functions in the modern castings *"BUYING TEAM"* —management . . . engineering . . . production— insures a balanced readership.

Sound Fundamentals —MODERN CASTINGS and American Foundryman reaches every foundry in the United States and Canada, with an ABC-audited, waste-free Circulation. Advertising rates are based on factual distribution figures . . . the only publication in the Castings field with an ABC-audited circulation.

MODERN CASTINGS
and
American Foundryman
combines the best elements known to publishing. Moreover, this magazine, literally, is

"OWNED by the Men Who Buy!"

ABC

MODERN CASTINGS
***and* American Foundryman**
GOLF and WOLF ROADS • DES PLAINES, ILLINOIS

Whiting standard 26" ladle and truck, equipped with EZ-Pour gearing and insulated cover. Has closed standards and no bail. Truck has 16" dia. wheels for 24 gauge track. Other gauges available.

Whiting teapot-spout crane ladle, 51" in diameter. Has special reinforcing around bowl and spout is equipped with EZ-Pour gearing.

Equipped with V bail, this Whiting cylindrical ladle is 28" in dia. by 33" long. Also has sliding type saver with adjustable lever and EZ-Pour gearing.

SPECIALLY ENGINEERED LADLES for special service

SPEED POURING... CUT COSTS!

Whiting knows ladles. Proof is the thousands of Whiting ladles in use... *reason* is Whiting's 70 years' experience building these ladles. That's why Whiting can give you the ladle you want and need. That's why Whiting's special engineering service means the best possible performance at the lowest possible cost.

For example, take a look at the specially engineered Whiting ladles shown on this page... only a few of many designed for specific applications. With such special features as structural steel spouts, riveted or welded heads and extra reinforced bowls, they withstand the toughest day-in-day-out, year after year service.

Remember, too—in addition to the "specials", Whiting carries a complete line of standard ladles... all known for their longer-lasting, economical performance. They include hand and shank ladles, covered trolley ladles, covered crane ladles, riveted crane ladles, geared and non-geared bottom-top ladles, cylindrical ladles, mixing and reservoir ladles.

Send today for complete information on all Whiting Ladles!

Whiting 27" by 90" U-Ladle with oil fired lining preheater and motor operated gear trunnion.

Whiting special 66" top diameter square bail combination lip and bottom pour ladle with laminated bail arms and heat shield, anti-friction trunnion bearings and helical worm gear bracket.

WHITING

FEMA

Mail this coupon today!

WHITING CORPORATION
15628 Lathrop Avenue, Harvey, Illinois

- ☐ Send Me A Whiting Ladle Catalog
- ☐ Have A Whiting Engineer Call

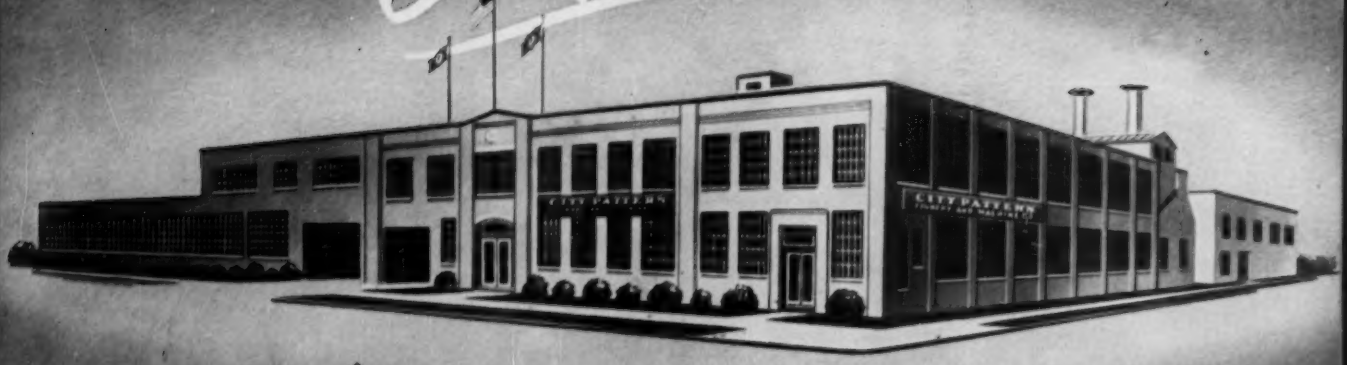
Firm _____

Attention _____

Address _____

City _____ Zone _____ State _____

Here are Complete facilities...



for your CAST AND MACHINED PARTS

City Pattern Foundry & Machine Company offers unparalleled facilities for the complete production of cast and machined parts. Working directly from your part print, we make the pattern, cast the parts and then precision machine them; all operations are performed right under our own roof.

In every phase of the processing the most modern methods and equipment are used. And to safeguard consistent high quality, every known piece of inspection equipment is on hand to chemically, physically and dimensionally measure your parts before shipment.

Thus, complete responsibility for your cast machined parts are in the hands of one competent, completely equipped source. Why not take advantage of the obvious benefits next time *you* are ordering cast and machined parts.

SETTING THE PATTERN IN PATTERNS

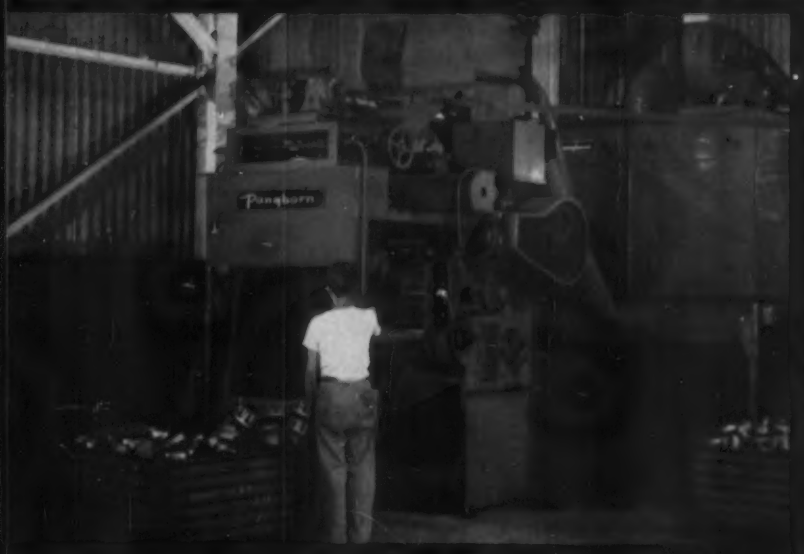
Since 1913...

CITY PATTERN

FOUNDRY AND MACHINE CO.

PHONE TR 4-2000 1161 HARPER AVENUE, DETROIT 11, MICHIGAN

Looking for cheaper blast cleaning?



PANGBORN BLAST CLEANS CHEAPER BECAUSE famous Pangborn Rotoblast cleans *fast.* Rotoblast throws a heavy volume of abrasive quickly over a large surface area. This speed of operation increases your rate of production, cuts operating expenses.

◀ BLASTMASTER Barrel for batch cleaning

Pangborn...

Pangborn...

PANGBORN BLAST CLEANS CHEAPER BECAUSE Rotoblast actually does a terrific job! Its uniform cleaning action economically produces a more desirable, brighter finish and allows more efficient use of high-speed machine tools in further processing.

ROTOBLAST ROOM for miscellaneous work ▶

Pangborn...

PANGBORN BLAST CLEANS CHEAPER BECAUSE Rotoblast saves labor costs . . . because it requires less power to operate . . . because its versatility accommodates a wide range of work. Send for Bulletin 227 today. Write PANGBORN CORPORATION, 1300 Pangborn Blvd., Hagerstown, Md. *Manufacturers of Blast Cleaning and Dust Control Equipment.*

◀ ROTOBLAST "GO" Barrel for continuous-flow requirements

Whatever Pangborn Rotoblast machine best suits your requirements . . .

Pangborn

BLAST CLEANS CHEAPER

Rotoblast Blastmaster® & Continuous-Flo Barrel

Rotoblast Tables & Table-Rooms

Special Blast Rooms & Cabinets

Pangborn Dust Control Equipment

Malleabrasive Shot & Grit

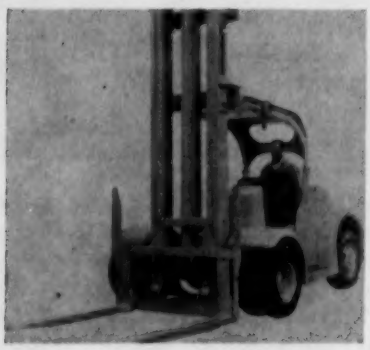
Products & Processes

Fill out postcards on pages 17-18 for complete information on items listed on pages 10-12-17-18-20

▲ Push-Button Coreblower

The new B&P Flexible CB5-CD is the first small coreblower to offer automatic push-button pneumatic operation. Its precision 2 in. draw is an invaluable feature for the core room that must handle small boxes that require a precision draw. The error-proof single push-button sequence control operates the draw too. One small button controls every operation in the blowing sequence. The B&P instant change blow plate feature is standard on this Flexible. Capacity—cores up to 4½ lb in weight. *Beardsley & Piper Div.*

For more facts, circle No. 462 on p. 17



▲ Lift Truck

With new 12,000-lb capacity lift truck, RT-120, added to line, Hyster has trucks available in following capacities: 1000, 2000, 3000, 4000, 6000, 8000, 10,000, 12,000, 15,000, 16,000, and 18,000 lb. Exclusive overhead tilting mechanism is said to reduce stress in the frame and tilt mechanism. Standard lift height of RT-120 is 17 ft 6 in. with optional heights available ranging from 8 ft 2 in. to 24 ft. Outside turning radius, 180 in.; overall width and wheelbase, both 86 in. *Hyster Company.*

For more facts, circle No. 463 on p. 17

▼ Utility Crane

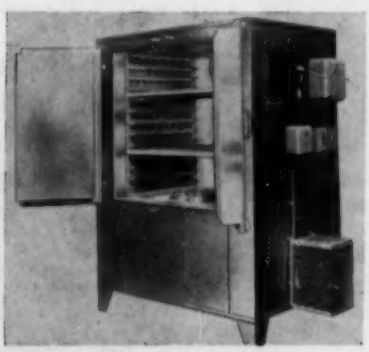
A self-propelled, one-man operated, rubber-tired utility crane is being introduced. Manufacturer states that the machine, with true power hydraulic control, offers unique advantages previously unknown to utility cranes. Designated as the UC-68, with 15-tons lifting capacity, the crane is an addition to the broad line of Link-Belt Speeder, Crawler and rubber-tires shovel-cranes manufactured at Cedar Rapids, Iowa. The UC-68 is specially designed for mobile work in industrial plants. *Link-Belt Speeder Corp.*

For more facts, circle No. 464 on p. 17

▼ Portable Industrial Ovens

A new line of portable industrial ovens for use in closely controlled production and laboratory work is being offered. Heavy-duty cabinet ovens are available with either horizontal or vertical air flow. Specially designed for temperature uniformity, the ovens are built strong for long, hard usage. Outstanding features include no metal-to-metal contact, high and low heat switch for close control and quick recovery and Inconel sheathed "life-time" heating elements. Bulletin No. 9-54, describes the ovens. *Carl Mayer Corp.*

For more facts, circle No. 465 on p. 17



▲ Emergency Damper Opener

A new thermally actuated emergency damper opener for Sky-Blast power roof ventilators is now available. Unit is designed to allow the roof ventilator to serve as a venting device for smoke, heat and fumes in the event of fire. Consisting of twin high-torsion alloy steel springs mounted on a telescoping steel tube support, the device is completely independent of electrical equipment. Spring arms are held in place by a fusible link which breaks when critical temperature is reached. *Robbins & Myers, Inc.*

For more facts, circle No. 466 on p. 17

▲ Gas-Electric Truck

A new 3000-lb truck has been added to the Gas-O-Matic line. Model FD-30 utilizes the exclusive Baker-Raulang variable voltage generator integral with a gasoline engine. This gives the performance of a gas engine truck with the economy of an electric truck, eliminating the clutch and transmission which are maintenance and replacement problems on ordinary gas fork trucks. Maximum travel speed with full load in 8 mph. Full-load lifting speed is 40 fpm. *Baker-Raulang Co.*

For more facts, circle No. 467 on p. 17

continued on page 12

FIRE CLAY
—close to the "heart" of Midwestern iron and steel industry
Modern metallurgy and furnace requirements call for complete, fast fire clay service from a nearby source. Leading Midwestern steel plants and foundries rely on the Illinois Clay Products Company with its extensive Goose Lake clay deposits, located near Joliet, only 55 miles from Chicago. Modern processing facilities and nearness to the "heart" of industry make Illinois Clay the perfect source for you!
ILLINOIS CLAY PRODUCTS COMPANY
Sales Office—Chicago, Illinois, 208 S. LaSalle St.
Main Office—Joliet, Illinois, Barber Building
GOOSE LAKE
Fire Clay Brick and Clays
THERM-O-FLAKE
High Temperature Vermiculite Insulation
CHEM-BRIX
Chemically Bonded Refractory

Products & Processes

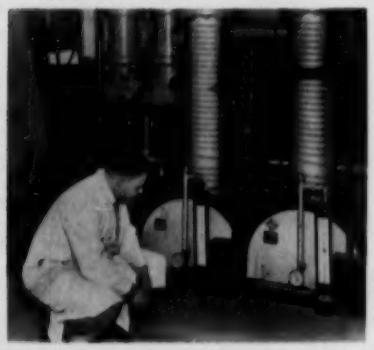
continued from page 10

Fill out postcards on pages 17-18 for complete information on items listed on pages 10-12-17-18-20

▲ Hand Fork Trucks

The Hi-Lo Stacker, a line of battery-powered, tilting fork hand trucks in 1500, 2000, 2500 and 3000-lb capacities, 24-in. load center, has been added to the Powrworker series of hand trucks. Equipped with Hi-Lo telescopic channel uprights, the fork truck provides a free lift of 64 in. with an 83-in. overall height and a maximum fork height of 130 in. Ten degrees of tilt back and three degrees forward are accomplished through a double-acting cylinder which rigidly supports the upright channels. *Clark Equipment Co.*

For more facts, circle No. 468 on p. 17



▲ Booster Pumps

Greatly increased throughputs in the pressure range from 10 to 500 microns, at high efficiency, is provided by the new Stokes Righ-Jet booster pumps recently introduced. This is the pressure range at which many of the new production-scale vacuum processes, including vacuum melting and casting, are carried out. These processes call for the evacuation of large volumes of air in addition to the vast out-gassing from the molten metal. Bulletins are available describing curves. *F. J. Stokes Machine Co., Inc.*

For more facts, circle No. 469 on p. 17

▼ X-Ray Scanning Spectrometer

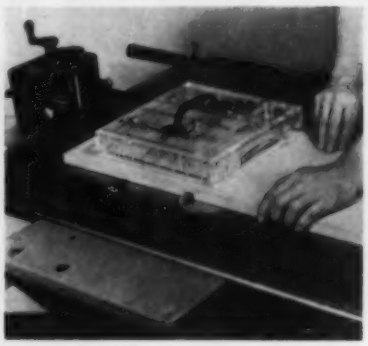
Introduction of a new non-destructive x-ray analytical tool has been announced. The instrument is the X-ray Scanning Spectrometer, suitable for qualitative or semi-quantitative analysis. According to the manufacturer, the new instrument provides accuracy comparable to the best chemical methods, with procedural simplicity, and speeds similar to direct-reading optical emission. Instrument is designed for either analytical research or production control. *Applied Research Laboratories.*

For more facts, circle No. 470 on p. 17

▲ Hydraulic Testing Machine

A unique portable hydaulic testing machine of 60,000 lb capacity in tension and compression has been developed. It will be available as the Model 60-A Baldwin-Tate-Emery universal portable testing machine. A feature of the new machine is its ability to apply both tension and compression in a common testing space over a fixed table 24 in. above the floor. A double-acting Emery hydraulic capsule is used in the weighing system which is independent of the hydraulic loading system. *Baldwin-Lima-Hamilton Corp.*

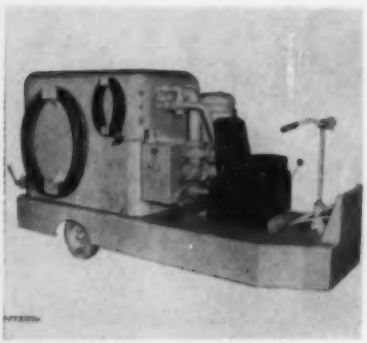
For more facts, circle No. 471 on p. 17



▲ Power-Saw Guard

A new fool-proof transparent safety guard for table saws is now available for distribution. Known as Brett-Guard, it gives comprehensive protection not only for ripping, mitering, compound mitering, rabbeting raised panel, short cross cutting and long cross cutting, but now for the heretofore unguardable operations of plowing, tonguing, drop sawing, tenoning diagonal sawing and template cutting. Exclusive feature is the precision-engineered guard standard of cast aluminum. *Brett-Guard Co.*

For more facts, circle No. 472 on p. 17



▲ Mobile Scavening Unit

The largest mobile scavenging unit yet marketed for big-plant cleaning of machine sumps and drainage pits has been announced. In 200-gal loads, the new Sludge-King collects, hauls and discharges waste oil, water and sludge containing metal chips and grindings, including abrasive elements, metal objects, string, wire, etc., regardless of viscosity. After collecting and hauling, the Sludge-King unloads quickly. Detailed and illustrated brochure is available. *Laidlaw Co.*

For more facts, circle No. 473 on p. 17

continued on page 17

U. S. Patent #2184926 (Other patents pending)

HOW RUGGED IS YOUR ABRASIVE ?

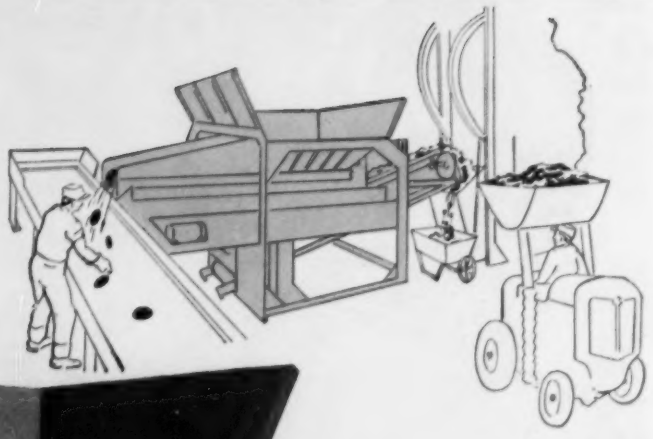
Is it rugged enough to prove itself in performance? You can't judge an abrasive by looks, claims or promises. The only test of any abrasive is its *cost per ton of castings cleaned.* Because of exclusive metallurgical characteristics, Malleabrasive gives you the lowest cost per ton cleaned of any premium abrasive on the market! This has been proved in hundreds of production tests by users throughout the country. Prove it in your own production test. *We GUARANTEE that Malleabrasive will give you lowest cost per ton of castings cleaned.*

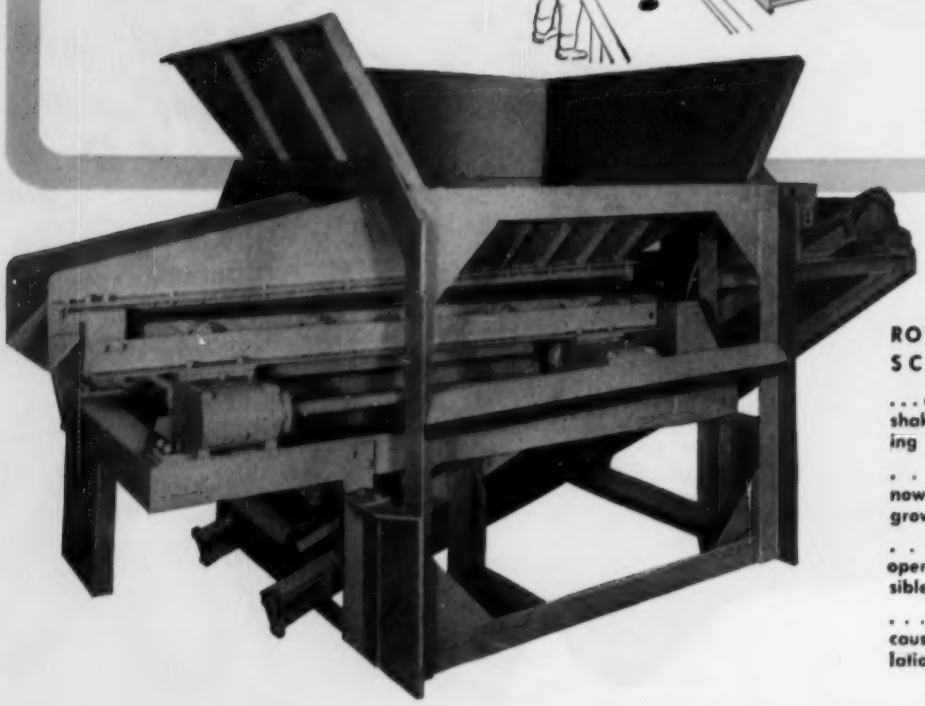
To order Malleabrasive, or for additional information on running a test, contact PANGBORN CORPORATION, 1300 Pangborn Blvd., Hagerstown, Md. *Manufacturers of Blast Cleaning and Dust Control Equipment.*

Pangborn DISTRIBUTORS FOR

MALLEABRASIVE

One Simple **MECHANIZED** Operation





ROYER "S-724-11M" SCRAP CONTROL

. . . eliminates hand labor in shake-out and sand cleaning

. . . gives mechanization now, yet allows for future growth

. . . provides mechanized operations at the lowest possible cost

. . . is easily relocated because of floor level installation

....SHAKES OUT castings and CLEANS your sand

The model "S-724-11M" Royer Scrap Control supplies mechanized casting removal and sand cleaning in one fast, efficient operation . . . giving you all of the benefits of labor saving and production line operation at the lowest possible cost.

Front end loaders scoop up sand and castings from the molding floor and deposit them into the ample hopper of the Royer. The rapid, positive walking-beam action of the shake-out breaks up the sand and conveys the castings and large scrap off the end to sorting table or conveyor. Magnetically cleaned sand is discharged at the opposite end to muller skip hoist, conveyor belt to a sand handling system or into a Royer Sand Separator & Blender for complete sand conditioning. Entire unit is above floor level, eliminating costly pits and excavations . . . high casting and sand discharges allow related equipment to also be located above floor level.

Investigate the possibilities for Royer "mechanization" in your plant. This new series of Scrap Controls, with capacities up to 60 tons of clean sand per hour, is available in models to suit your needs. We will be glad to study your operations and make our recommendations at no obligation to you. Write today.

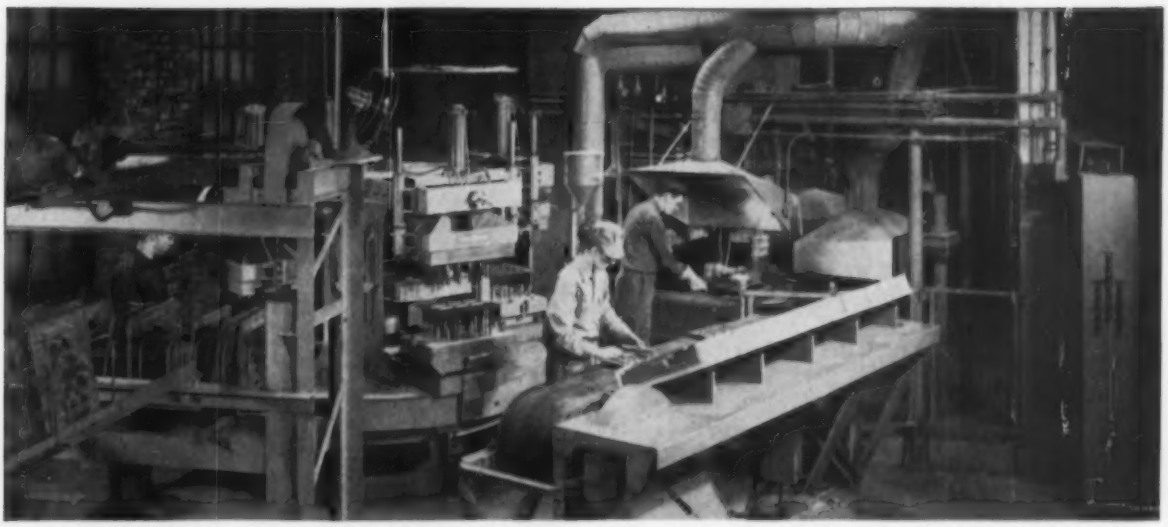
Export Department, 306 W. Washington Blvd.
Chicago 6, Ill., U.S.A. Cable: ASMAN

Foremost in Sand ROYER *Conditioning Equipment*

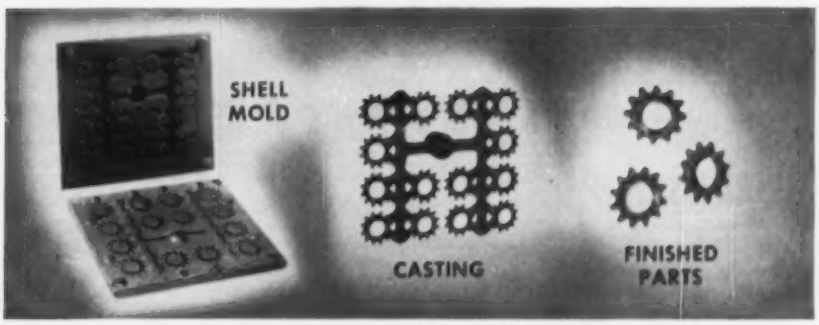
ROYER FOUNDRY & MACHINE CO. 155 PRINGLE ST. KINGSTON, PA.

For more facts, circle No. 528 on postage-free Reader Service card on p. 17 or 18

Link-Belt ANNOUNCES new automatic shell molding system



THE LINK-BELT SHELL MOLDING SYSTEM has been proved in service, and can be operated by relatively unskilled labor. Thin molds of resin-bonded sand are made at the molding machine (right background). Cores are inserted in the drag on the belt conveyor (foreground). Cope and drag are joined in the closing machine (center). Finished molds ready for pouring are removed from closing machine and placed in storage conveyor (left foreground).



THIS IS SHELL MOLDING. Clean, smoothly-joined shell molds reduce finishing costs, assure high-volume output of sound, top-quality castings—even those of intricate, thin-sectioned design.

NEW BOOK 2462 on the Link-Belt advanced automatic shell molding system contains facts of importance for every foundry.

Achieves high volume production of precision castings requiring little or no machining

Now Link-Belt brings the foundry industry a new automatic system that utilizes fully the advantages of the much-acclaimed shell molding method. To its many basic benefits, Link-Belt Shell Molding and Closing Machines contribute important advancements which assure quality molds.

In speed, compactness and automatic control, this system is particularly outstanding. Continuous tests have proved its efficiency under full-scale production conditions. Important, too, Link-Belt offers you a single source for a complete, integrated system. This includes molding and closing machines, molding, pouring, cooling, shakeout and sorting conveyors.

Can shell molding be profitable for you? It's worth your time to get the facts from your nearest Link-Belt office. Ask for a copy of Book 2462, containing full explanatory and specification data.

LINK-BELT

SHELL MOLDING SYSTEM

LINK-BELT COMPANY: Executive Offices, 307 N. Michigan Ave., Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 15); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World. 13.840

VOLCLAY BENTONITE

NEWS LETTER No. 39

REPORTING NEWS AND DEVELOPMENTS IN THE FOUNDRY USE OF BENTONITE

SAND

is only a PART!

Photo Courtesy of Hydro-Blast Corp.

Sand is only a part of the foundry, yet it is often accused of a huge toll in casting losses. We think its batting average is better than it sounds.

Sand and sand mixtures are accused so often that few consider production costs are frequently excessive because the **vast knowledge of foundry practice is not applied in every foundry problem.**

With the gradual passing of the "skilled molder", comes the "mechanized unit operator". The "floor molder" and the "mechanized molder" must not be used interchangeably; one is an individual, the other is part of a team.

A "mechanized unit operator" relies entirely upon the sand conditioning units to prepare proper sand for his use. He relies upon the judgment and ability of the pattern and technical staff to place the gate and sprue in the correct location to warrant a good casting.

He further relies upon the maintenance crew to insure that the machine is in perfect working condition and that it performs correctly when it is set and gauged by the foreman. This machine often standardizes the number of rams, corrects the air squeeze pressure, corrects the lift, and controls other mechanical details that go into the performance of good mechanized molding practice.

The "mechanized unit molder" is an operator. The tools and the knowledge must certainly be furnished if production is to be maintained. **The complete practice is a formality** and for that reason it is termed, "mechanized". It is a "teamwork" function.

Although sand is only part of this "team", too often it is the "goat" for any, and all, scrap! **Poor foundry practice results in a waste of raw materials** and encourages trying excessive additions of raw materials to overcome poor practice.

How much excess binder do you need to correct a poorly gated mold poured with cold iron?

Foundrymen who fail to use good gating practice, proper melting practice, proper control of all operations, will certainly have a larger percentage of casting defects.

Sand and sand mixtures cannot carry the complete burden as more "team errors" enter into scrap losses as production increases. **Wasteful habits rise during the periods of high demand.**

Sand is only part of the foundry machine. A good bond, or bonds, minimizes scrap . . . but may not completely eliminate it. CHECK THE "TEAM ERRORS".

AMERICAN COLLOID COMPANY

Chicago 54, Illinois • *Producers of Volclay and Panther Creek Bentonite*

For more facts, circle No. 535 on postage-free Reader Service card on p. 17 or 18

Products & Processes

continued from page 12

Fill out postcards on pages 17-18 for complete information on items listed on pages 10-12-17-18-20

More data, information, prices can be obtained on all advertised and listed products, bulletins, services by using postage-free Reader Service card

Nickel Cast Electrode

A new electrode, Pacific Nickel Cast, has been placed on the market. Electrode is especially recommended for the repair welding of cast iron. Weld itself is easily machinable under all conditions of deposition. Descriptive literature is available. *Pacific Welding Alloys Mfg. Co.*

For more facts, circle No. 474 on card

Rivetless Chains

A new series of drop-forged rivetless chains for overhead conveyor use has been developed. Chains are dimensionally interchangeable with other makes. Features of the chains are dry lubricant impregnated pins and machined bearing surfaces. *U.S. Engineering Co.*

For more facts, circle No. 480 on card

Belt-Drive Ventilator

Belt-Drive aluminum centrifugal ventilator which weighs only 250 lb in the 16,500 cfm size has been introduced. Motor and belt-drive can be quickly inspected by raising the hinged hood. By removing four bolts, the entire shell can be lifted off for easy cleaning. *Loren Cook Co.*

For more facts, circle No. 475 on card

Refractory Rammer

A minimum of downtime for the application and patching of refractory may be realized through the use of a new pneumatic rammer known as Model G-162D. Light and easy to handle, the rammer delivers a controlled, powerful recoilless stroke. *Burgess-Sterbentz Corp.*

For more facts, circle No. 481 on card

Multi-Point Pyrometer

A system to permit taking nearly simultaneous temperature readings at several points on a single, centrally located pyrometer, has been announced. System consists of several thermocouples, each at different locations, connected to a high-resistance pyrometer. *West Instrument Corp.*

For more facts, circle No. 476 on card

Gas Mask Kit

A gas mask kit designed to meet any plant hazards for millwrights and maintenance men has been announced. The Acme Maintenance Mask provides a full-vision face piece, a canister mask and an air-supplied mask (plant compressed air). *Acme Protection Equipment Co.*

For more facts, circle No. 477 on card

Electrolytic Etching

Micromet Etcher is a modern apparatus for electrolytic etching of metallographic specimens, always ready to operate, eliminating time consuming hook ups and delays due to battery failure. Many materials which are inert to standard chemical etching will respond. *Buehler, Ltd.*

For more facts, circle No. 478 on card

Low-Pressure Spray Gun

Model P-300 is an air operated siphon paint spray gun, designed to operate on air pressure as low as 5 lb psi. Light in weight it draws from a one quart cup. Permits its use for such things as applying silicone mold release oils. *John B. Moore Corp.*

For more facts, circle No. 479 on card

Reader Service Dept. 55|6

Please have manufacturer send me without obligation information or bulletins indicated by numbers circled. For uncoded advertisements and Here's How items show page numbers on line below. For reprints or bibliographies show code numbers on line below.

PRODUCTS & PROCESSES				462	463	464
465	466	467	468	469	470	471
472	473	474	475	476	477	478
479	480	481				
FREE INFORMATION			482	483	484	485
486	487	488	489	490	491	492
493	494	495	496	497	498	499
500	501	502	503	504	505	506
507						
ADVERTISED PRODUCTS & SERVICES				508	509	
510	511	512	513	514	515	516
517	518	519	520	521	522	523
524	525	526	527	528	529	530
531	532	533	534	535	536	537
538	539	540	541	542	543	544
545	546	547	548	549	550	551

★ Please print or type information below

NAME

TITLE

COMPANY

ADDRESS

CITY AND ZONE

Postage Will be Paid by Addressee

No Postage Stamp Necessary If Mailed in the United States

BUSINESS REPLY CARD

First Class Permit No. 83, Sec. 34.9 P. L. & R. DES PLAINES, ILL.

Reader Service Dept.

AMERICAN FOUNDRYMAN

Golf & Wolf Roads

Des Plaines, Illinois

Free Foundry Information

Fill out postcards on pages 17-18 for complete information on items listed on pages 10-12-17-18-21-22

Electric Arc Furnace

Bulletin X evaluates the electric furnace in the light of current management problems. After a brief review of major applications, it covers such topics as: On-and-off economy, heat efficiency versus fuel cost, more production per dollar of investment. *Whiting Corp.*

For more facts, circle No. 482 on card

Phenolic Resin

Technical Bulletin F-3 explains Reichold's two-stage, thermosetting, powdered phenolic resin, Foundrez 7500, for making shell molds. Points out how for large and small parts cast with any ferrous or non-ferrous material, Foundrez 7500 is ideal. *Reichold Chemicals, Inc.*

For more facts, circle No. 484 on card

Blast Cleaning

Bulletin 227 explains how the Pangborn Rotoblast throws more abrasive over a larger area quickly—giving a thorough cleaning job in less time at less cost. Covers complete line of blast cleaning equipment including barrels, tables, and special machines. *Pangborn Corp.*

For more facts, circle No. 486 on card

Vibrating Conveyors

Complete catalogue and performance data are available describing vibrating conveyors, vibratory feeders, and hopper level switches. Vibrating conveyors with extra length screening capacity plus dual trough design are discussed. *Syntron Co.*

For more facts, circle No. 483 on card

Furnace Catalogue

Lectromelt Furnace Catalogue No. 9 points out the value of precise control of temperature and analysis made possible with a Lectromelt Furnace. Flexibility of production and the matter of casting special heats are discussed. *Pittsburg Lectromelt Furnace Corp.*

For more facts, circle No. 485 on card

Jig Saws

Bulletins are now available describing the No. 173E Jig Saw which cuts patterns up to nine in. thick with accuracy and No. 173S Jig Saw that has upper tension unit mounted on ceiling for unlimited capacity. Table is 73 or 34 in. square. *Oliver Machinery Co.*

For more facts, circle No. 487 on card

Postage Will be Paid by Addressee

No Postage Stamp Necessary If Mailed in the United States

BUSINESS REPLY CARD

First Class Permit No. 83, Sec. 34.9 P. L. & R. DES PLAINES, ILL.

Reader Service Dept.
AMERICAN FOUNDRYMAN
Golf & Wolf Roads
Des Plaines, Illinois

Shell Molding System

Book 2462 describes the new Link-Belt Shell Molding System in eight thoroughly-illustrated pages. Gives a step-by-step picture of sand handling, molding and closing operations. Also demonstrates the outstanding advantages offered. Includes specifications. *Link-Belt Co.*

For more facts, circle No. 488 on card

Crucible Furnace

Bulletin 57-A describes the Lindberg-Fisher type MNP nose-pour tilting crucible furnace. Pouring lip is located in the axis of tilting providing a constant pouring arc regardless of degree of furnace tilt. Capacities up to No. 800 crucible with brass. *Lindberg-Fisher.*

For more facts, circle No. 489 on card

Core Plates

Folder PP-31A gives complete details on Transite Core Plates and Slip Jackets as well as Transite Pallite products for dielectric furnaces. Tells how core plates are strong and durable—resist warpage, impact and abuse, provides long service life. *Johns-Manville.*

For more facts, circle No. 490 on card

Hot Blast Heaters

Literature is available describing the direct-fired Todd-Thermo Hot Blast Heater, utilizing gas or oil for fuel. Unit employs a floating type exchanger section, composed of two or more banks of "U" or hairpin staggered tubes. *Grindle Corp.*

For more facts, circle No. 491 on card

continued on page 20

Reader Service Dept. **55|6**

Please have manufacturer send me without obligation information or bulletins indicated by numbers circled. For unaided advertisements and Here's How items show page numbers on line below. For reprints or bibliographies show code numbers on line below.

PRODUCTS & PROCESSES			462	463	464	465
466	467	468	469	470	471	472
473	474	475	476	477	478	479
480	481					
FREE INFORMATION			482	483	484	485
486	487	488	489	490	491	492
493	494	495	496	497	498	499
500	501	502	503	504	505	506
507						
ADVERTISED PRODUCTS & SERVICES			508	509	510	511
512	513	514	515	516	517	518
519	520	521	522	523	524	525
526	527	528	529	530	531	532
533	534	535	536	537	538	539
540	541	542	543	544	545	546
547	548	549	550	551		

★ Please print or type information below

NAME

TITLE

COMPANY

ADDRESS

CITY AND ZONE

SITUATION UNDER CONTROL **BY KEOKUK**

'CHIEF KEOKUK:

"Ugh! Heap smart little chief. I say, Rub sticks to start fire. Him rub MATCH sticks!"

PRINCESS WENATCHEE:

"Yes, Junior has everything under control!"

KEOKUK ELECTRO-METALS COMPANY

KEOKUK, IOWA

WENATCHEE DIVISION, WENATCHEE, WASHINGTON

There's just no match for Keokuk Silvery Pig Iron to control quality and costs. *Due to its exact, uniform analysis, Keokuk assures less waste resulting in greater economy.* Car for car, pig for pig, its uniformity *never* varies. Charge Keokuk by magnet or count!

Keokuk Silvery . . . the superior form of silicon introduction for steel plants and foundries . . . available in 60 and 30 lb. pigs and 12½ lb. piglets . . . in regular or alloy analysis. Keokuk also manufactures high silicon metal.

SALES AGENT: MILLER AND COMPANY

332 S. Michigan Ave., Chicago 4, Illinois
3504 Carew Tower, Cincinnati 2, Ohio
8230 Forsyth Blvd., St. Louis 24, Missouri

Free Foundry Information

continued from page 18

Fill out postcards on pages 17-18 for complete information on items listed on pages 10-12-17-18-20

Radiography

Booklet *"Radiography as a Foundry Tool,"* tells how a steel valve casting was checked by radiography for soundness and revealed the presence of sand inclusions. These were chipped out, a second radiograph showed a sound, homogeneous casting. *Eastman Kodak Co.*

For more facts, circle No. 492 on p. 18

Sand Distribution

Folder describing the automatic sand distribution equipment manufactured by Harry W. Dietert Co., is now available. Includes plant diagram and explains how the Sand Monitor coordinates mulling and distribution. Also explains Hoppertrol operation. *Harry W. Dietert Co.*

For more facts, circle No. 498 on p. 18

Scabbing

Volclay Bentonite News Letter No. 38 discusses scabbing. Says the chief source of scabs is high sand expansion, combined with high hot strength. Claims Five Star Wood Flour overcomes sand expansion. As little as 1 per cent insures against scabs. *American Colloid Co.*

For more facts, circle No. 502 on p. 18

Furnace Installation

Bulletin HT-53 illustrates an outstanding heat-treat furnace installation blueprinted by Carl Mayer to fit a given requirement. The recirculating, gas-fired, car bottom type was engineered to meet a high temperature range requirement. *Carl Mayer Corp.*

For more facts, circle No. 493 on p. 18

Foundry Flasks

Foundry Flask Handbook is a handy catalog and useful foundryman's "bible" and includes an easy-to-order system. Explains the way the flasks are made and designed and points out how flasks are built to stand continued use. *Foundry Flask Div., Black, Sivalls & Bryson, Inc.*

For more facts, circle No. 494 on p. 18

Reprints and Bibliographies

Reprints and bibliographies listed below have been made available by the AFS Technical Dept. or by AMERICAN FOUNDRYMAN. Ask for them by giving code designation on dotted line of postpaid Reader Service Card, pages 17-18.

RB1 . . *"Casting Design"*
RB2 . . *"Gating and Risering"*
RB3 . . *"AFS Research"* (lists 58 papers)
RB4 . . *"Nondestructive Testing"*
RB5 . . *"Machinability"*
RB6 . . *"Casting Defects"*
RB7 . . *"Foundry Layouts"*
RB8 . . *"Shell Molding"*
RB9 . . *"Basic Cupola"*
RB10 . . *"Foundry Sand Practice"*
RB11 . . *"Welding of Cast Metals and "Salvaging"*

Flux Data

An illustrated, fact-filled presentation of Apex aluminum fluxes and how they can contribute to the economical production of better aluminum castings is contained in a new brochure just published. Features a discussion of the sources of contaminants. *Apex Smelting Co.*

For more facts, circle No. 503 on p. 18

Materials Handling Folder

Bulletin No. 1206 MH is a complete list of products manufactured in the materials handling field. For ease of reference it has been printed as a letter-size file folder which can be used as an efficient means of filing catalog information for materials handling equipment. *Market Forge Co.*

For more facts, circle No. 504 on p. 18

Steel Shot

Bulletin 89-B details the savings realized by a Toledo firm that switched to Wheelabrator Steel Shot. The hardness of Wheelabrator Steel Shot (42 to 50 Rockwell C), and rebound properties are described in the booklet. *American Wheelabrator & Equipment Corp.*

For more facts, circle No. 495 on p. 18

Temperature Control Systems

Bulletin F 6149-2 contains control terminology, as well as rules to use as a guide for the selection of a proper method of control for process characteristics. Also contains a complete explanation of the various types of control systems. *Barber-Coleman Co.*

For more facts, circle No. 499 on p. 18

Grinding Wheels

Catalog 1052 includes a consumer net prices supplement. Also offers recommended wheel speeds in sfpm and covers grinding wheel markings, and shapes. Specifications are listed for all types of grinding wheels and booklet is illustrated with action shots of wheels. *Norton Co.*

For more facts, circle No. 505 on p. 18

Vibrating Conveyors

Bulletin 39 tells how Ajax Lo-Veyors not only convey but separate and screen foundry sand, tramp iron and core wires. They are made in a wide range of lengths, widths and capacities. Elimination of exposed bearings reduce maintenance costs. *Ajax Flexible Coupling Co., Inc.*

For more facts, circle No. 496 on p. 18

Ventilating Units

Bulletin No. UVS 103 discusses the General Util-A-Vent ventilating units, forward curve and backward blade. Photos of actual installations as well as diagrams and charts are included. Special features of the unit and various accessories available are also listed. *General Blower Co.*

For more facts, circle No. 500 on p. 18

Rotary Blowers

Bulletin No. 255 illustrates and describes several new applications for blowers. Booklet reviews the application of blowers as super-chargers and scavenging blowers. Also contains table and graphs to make it easy to determine the proper size unit to be used. *Miehle-Dexter Blowers.*

For more facts, circle No. 506 on p. 18

Induction Furnaces

Bulletin 27-B points out how freedom from contamination and almost complete metal recovery are direct results of the high speed characteristic of the Ajax-Northrup melting principle. Many furnaces accept either ferrous or non-ferrous work. *Ajax Electrothermic Corp.*

For more facts, circle No. 497 on p. 18

Fire Hood

Bulletin No. 1301-4 is now available describing a new fire hood, which protects the head, face, neck and shoulders against extreme heat. Hat and side shields are aluminum while the ¼-in. plastic lens permits full vision. *Mine Safety Appliances Co.*

For more facts, circle No. 501 on p. 18

Semi-Pressure Fans

Bulletin S-50 tells how to get top efficiency against resistances to 4½ in. SP without special equipment. Standard Aerovent units with new 7-blade propellers move more air at slower motor speeds. Can be used for cooling, drying, and exhausting. *Aerovent Fan Co., Inc.*

For more facts, circle No. 507 on p. 18

- *Speeds Curing — 10 times faster than conventional oven baking*
- *Affords 60% Fuel Savings*
- *Produces Smoother Finishes*

SIMPLIFIED OPERATION

"Tell-All" control panel, consisting of meters, lights, buttons grouped at eye level, enables operator to keep on top of the complete operation at all times—to maintain top level production with maximum speed and accuracy.

All the advantages of dielectric baking... *plus*

EXACT QUALITY CONTROL

Adjustable electrode control permits correct compensation for physical variances in cores — eliminates burning or incomplete baking, even when cores have very thin or thick sections.

- *Frees Storage Area*
- *Eases Shakeout*
- *Improves Working Conditions — cleaner, cooler*

"LOAD MASTER" PROTECTION

Automatic grid control assures correct drive to the oscillator tube regardless of oven load. Automatic conveyor control prevents electrical overload by controlling the belt travel when load is too great for normal operation.

Get all the facts on the *Foundromatic* dielectric core oven. Call your nearby Allis-Chalmers district office, or write Allis-Chalmers, Milwaukee 1, Wisconsin. Ask for Bulletin 15B7306B.

Foundromatic is an Allis-Chalmers trademark.

EXTRA SAFETY FEATURES

The *Foundromatic* core oven provides greater safety for operator and machine. Metal cabinet is designed to trap radiation. Door safety interlocks remove power when cabinet is opened for inspection.

A-4707

ALLIS-CHALMERS

NO SINGLE ABRASIVE

can do ALL blast cleaning jobs BEST

It is a fact that your own requirements as to finish and speed determine the type of abrasive you should use. As an example: for heavy cleaning chilled iron shot or grit is indicated; for less severe cleaning or scale removal annealed iron shot or grit may be used. Controlled T "chilled" and Permabrasive "annealed" shot and grit are engineered for the jobs they are to perform. We'll guarantee that our abrasives will produce a savings over your present abrasive costs or we will give you a check to cover the guaranteed savings.* How can you lose? Now is the time to make a test—now is the time to save on your blast cleaning costs.

*10% in the case of Permabrasive
15% in the case of Controlled T

produced by

THE NATIONAL METAL ABRASIVE COMPANY
Cleveland, Ohio

THE WESTERN METAL ABRASIVES COMPANY
Chicago Heights, Illinois

SOLD EXCLUSIVELY BY

HICKMAN, WILLIAMS & COMPANY
(INCORPORATED)

CHICAGO • DETROIT • CINCINNATI • ST. LOUIS • NEW YORK
CLEVELAND • PHILADELPHIA • PITTSBURGH • INDIANAPOLIS

For more facts, circle No. 544 on postage-free Reader Service card on p. 17 or 18

鋳物不良の原因と対策

That's how they write it in Japan where a translation of ANALYSIS OF CASTING DEFECTS, has just been issued through an arrangement with the American Foundrymen's Society. The Japanese version is identical with the American original and includes the same pictures. Publisher is Maruzen Co., Ltd., Tokyo.

ANALYSIS OF CASTING DEFECTS covers 31 basic defects attributable to 10 specific and one general phase of foundry operation. Each defect is defined and both major and minor causes are listed.

List Engineering Students Available for Summer Work

Over 200 engineering college students available for summer foundry work are listed by the Foundry Educational Foundation in the March issue of *Foundry Engineer*. Students from 20 schools are classified under those holding F. E. F. scholarships, engineering students who have elected the foundry sequence in F.E.F. universities, and engineering students in regular courses. In addition there is a special listing of foreign students desiring summer work in foundries.

The bulletin gives the name of the student, his student and home address, course, personal data, industrial experience, and preference in type and location of work.

Gray Iron Redesign Contest Deadline Is July 1

Foundrymen interested in entering the Redesign Contest of the Gray Iron Founders' Society are urged to send in their entries by July 1 to meet the deadline.

You are eligible if you are engaged in the metal-working trades and if you have redesigned a product or part for production in gray iron which economically and efficiently replaced a competitive material or process. Entries may be made jointly by two or more individuals. The most unique redesign will be awarded $500. Second prize is $250, third prize is $100. Awards will be made at the 27th annual meeting of G.I.F.S. in Milwaukee, Oct. 21, 1955

To enter, just follow these easy rules:

1. Select the best example of products or parts that you have redesigned for production in gray iron.

2. Give all facts leading up to your redesign . . . why you thought of gray iron . . . how much was saved in labor and/or material costs . . . how much efficiency was gained and any other factors leading to your decision.

3. Submit an 8 x 10-in. glossy photo of the gray iron casting with your entry. If possible, also submit a similar photo of the original design.

4. Put your entry in the mail by July 1, 1955, the contest closing date. Address: Redesign Contest, Gray Iron Founders' Society, Inc., National City-E. 6th bldg., Cleveland 14, Ohio.

PROFIT PICTURES

Foundry cuts core baking time 85% with electronic oven and **Resimene 970**

Close-up of finished gear case housing made for Maytag washer. Note intricate design, smooth finish and sharp corners obtained with Resimene 970 Core Binder.

Core bonded with Resimene 970 is inspected at receiving end of the electronic oven. Superior resistance of Resimene to moisture eliminates many problems.

MONSANTO UREA RESIN IS HELPING RAISE PRODUCTION 75% AND REDUCE SCRAP TO WITHIN 4%

Under-baked, low-density cores which produce rough, inferior castings have been one of the foundry industry's biggest production headaches.

In the past, foundry men had to "live" with this problem—but it isn't necessary today.

New techniques and materials—such as Monsanto's Resimene 970 urea core binding resin—make it possible to work with quick-baking, high-density cores that eliminate moisture damage, minimize scrap and satisfy the customers' demands for a fine cast finish.

For more than 4 years the Albert Lea Foundry Company (Albert Lea, Minn.) has been using Resimene 970 for precision casting jobs such as parts for the Maytag washing machine.

"The quick-baking qualities of Resimene 970," says R. A. Trow, Vice-President, "have helped us raise our production rate 75% and enabled us to work to an entirely new set of quality standards."

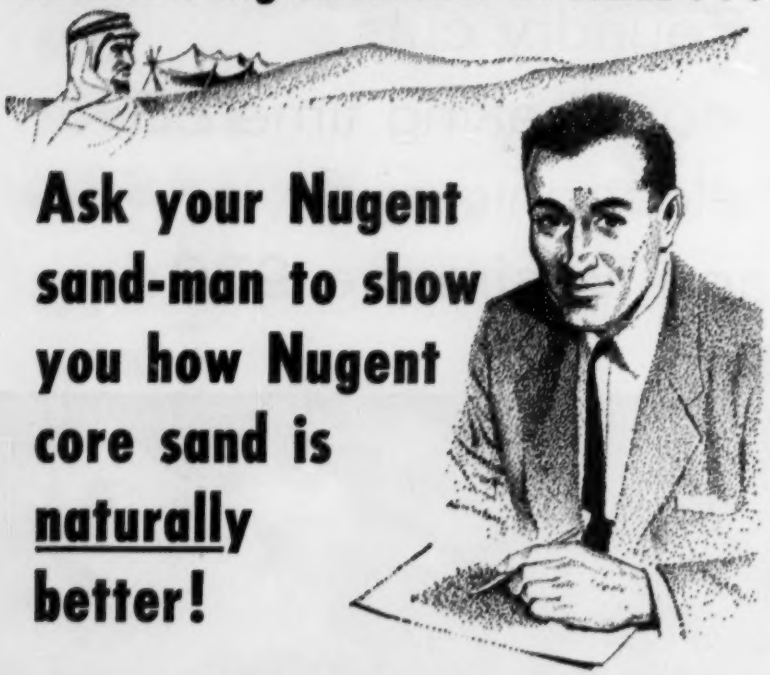
For phenolic or urea foundry resins that are research-developed and shop-tested to meet *your* needs, write first to Monsanto Chemical Company, Plastics Division, Dept. AF6, Springfield 2, Mass.

For stronger, better cores specify

RESIMENE®

MONSANTO

There's a big difference in sands . . .



Ask your Nugent sand-man to show you how Nugent core sand is naturally better!

Put samples of Nugent sand to the test in your sand lab — you'll *see* why it's naturally better! Nugent sand is processed from the best Muskegon dune sand, washed pure by nature for centuries . . . kiln-dried to the correct moisture content, then graded to a uniform AFS grain analysis. This means less core breakage, consistently uniform molds, greater pattern definition and finish, plus freedom from defect-producing components.

5 GRADES OF CERTIFIED SAND

A constant AFS grain analysis of 40, 44, 49, 52 and 55 is maintained through continuous testing with up-to-date laboratory methods. Exacting control processes result in uniform green strength, permeability, moisture, grain distribution, and other characteristics. You get *known* sand quality and unsurpassed uniformity from a source preferred by foundrymen for over 40 years.

See your Nugent sand-man or write direct for proper core sand recommendations. Samples on request.

Represented by —

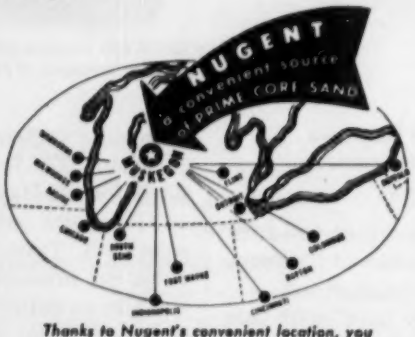
INDIANA PRODUCTS CO.
Kokomo, Indiana

WARNER R. THOMPSON CO.
Detroit 8, Michigan

CARPENTER BROTHERS, INC.
Milwaukee 3, Wisconsin

KEENER SAND & CLAY CO.
Columbus 15, Ohio

GREAT LAKES FOUNDRY SAND CO.
Detroit 26, Michigan



Thanks to Nugent's convenient location, you can count on prompt shipments of sand by 3 main railroads or truck when you need it.

CANNON CORE SAND

Nugent is always ready to serve you with graded sands for the foundry.

THE NUGENT SAND CO., INC.
MUSKEGON, MICHIGAN

For more facts, circle No. 546 on postage-free Reader Service card on p. 17 or 18

How to Identify Returns

Problem of keeping heads, gates, sprues, and risers of castings from heats of differing analysis separate has been solved by National Alloy Div. of Blaw-Knox Co., Pittsburgh, Pa. According to Martin N. Ornitz, works manager, the burner in the cleaning room is notified of the analyses of all heats each day and is given paints with which to color code returns.

This system cuts costs often incurred in returning the proper material for melting.

Plan Ohio Regional

"Better Castings for Better Living" is the theme of the 1955 Ohio Regional Foundry Conference, to be held in Cleveland at Case Institute of Technology on Thursday and Friday, October 20-21.

Simultaneous gray iron, malleable, steel, and non-ferrous sessions will be held Thursday afternoon and Friday morning. General sessions are scheduled for Thursday morning and Friday afternoon. Two luncheons are at Case. The banquet will be Thursday evening at the Tudor Arms Hotel, the headquarters for out-of-town guests.

The following officers of Ohio chapters of the American Foundrymen's Society are planning the conference: Lewis T. Crosby, Sterling Wheelbarrow Co., and A. D. Barczak, Superior Foundry Inc., vice-chairmen, Northeastern Ohio; Charles E. Eggenschwiler, Bunting Brass & Bronze Co., and Wayne W. Camp, Freeman Supply Co., chairman and vice-chairman, respectively, Toledo; H. A. Biddinger, F. E. Byers & Bros. Co., vice-chairman, Canton District; N. H. Keyser, Battelle Memorial Institute, and Karl G. Presser, Gray Iron Research Institute, vice-chairman and secretary, respectively, Central Ohio; and John D. Sheley, Black Clawson Co., vice-chairman, Cincinnati District.

Offer First Foundry Teacher-Training Course

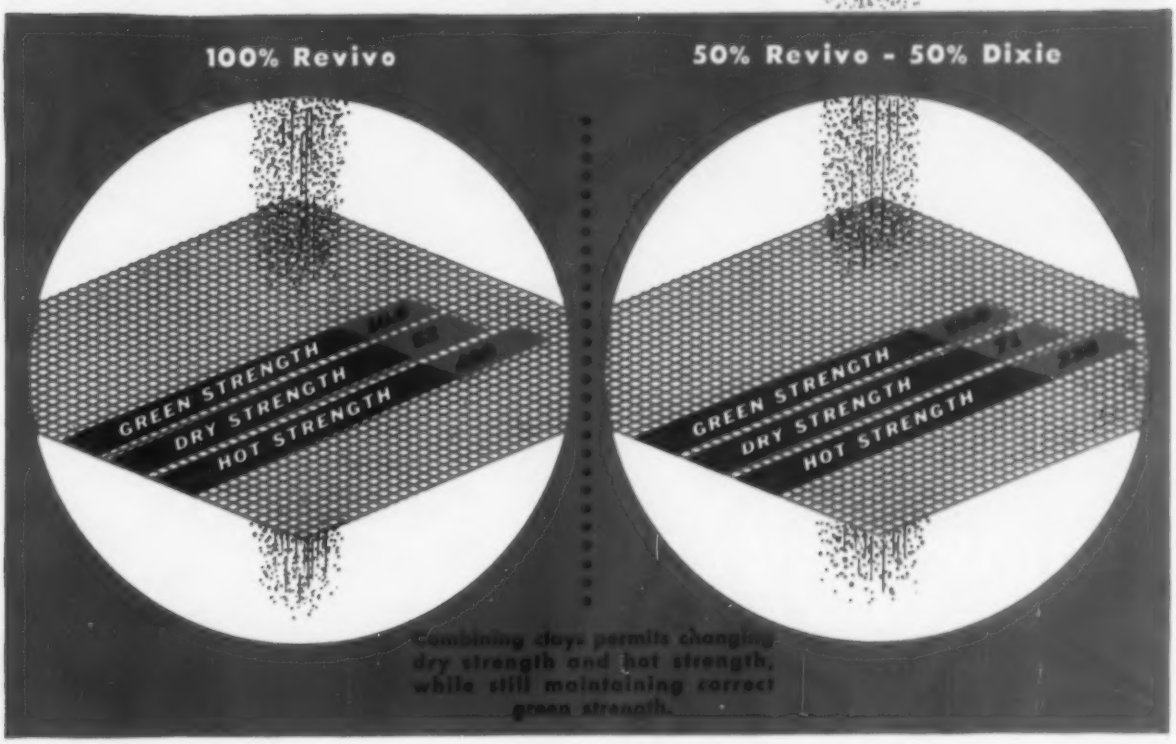
A special two-week, post-season, teacher-training course in foundry work is being offered by Michigan State University, Aug. 1-12. The course is designed to prepare high school industrial arts and shop teachers to develop an area in their own general shops for the instruction and practice of foundry work.

Prof. C. C. Sigerfoos will instruct teachers in essential manipulative processes, planning the placement of metal casting facilities in their own school shop, construction of much of the needed equipment, and development of course plans.

The course is approved for three credits which may be applied toward the master's degree at Michigan State University. Enrollment is limited to 15 students. For further information on course, registration, and fees, write Dean, School of Education, Michigan State University, East Lansing, Michigan. For information regarding housing and accommodations (married or single) inquire of Thomas Dutch, Director of Housing Assignments, A-Wells Hall, Michigan State University.

REVIVO BOND and its combinations

help increase your foundry yield



Correct combinations of quality clays reduce scrap and increase yield

Because Revivo is the most durable bond clay marketed to foundrymen today, it is an ideal base for combination with Black Hills Bentonite and/or Dixie Bond. Because Revivo has the highest strength of all the fire clay binders, you require less of it and yet obtain maximum permeability. Its high purity and maximum refractoriness reduce sand defects. . . In short, rely on Revivo to give you maximum durability, minimum scrap and maximum *yield*.

International Minerals & Chemical Corporation

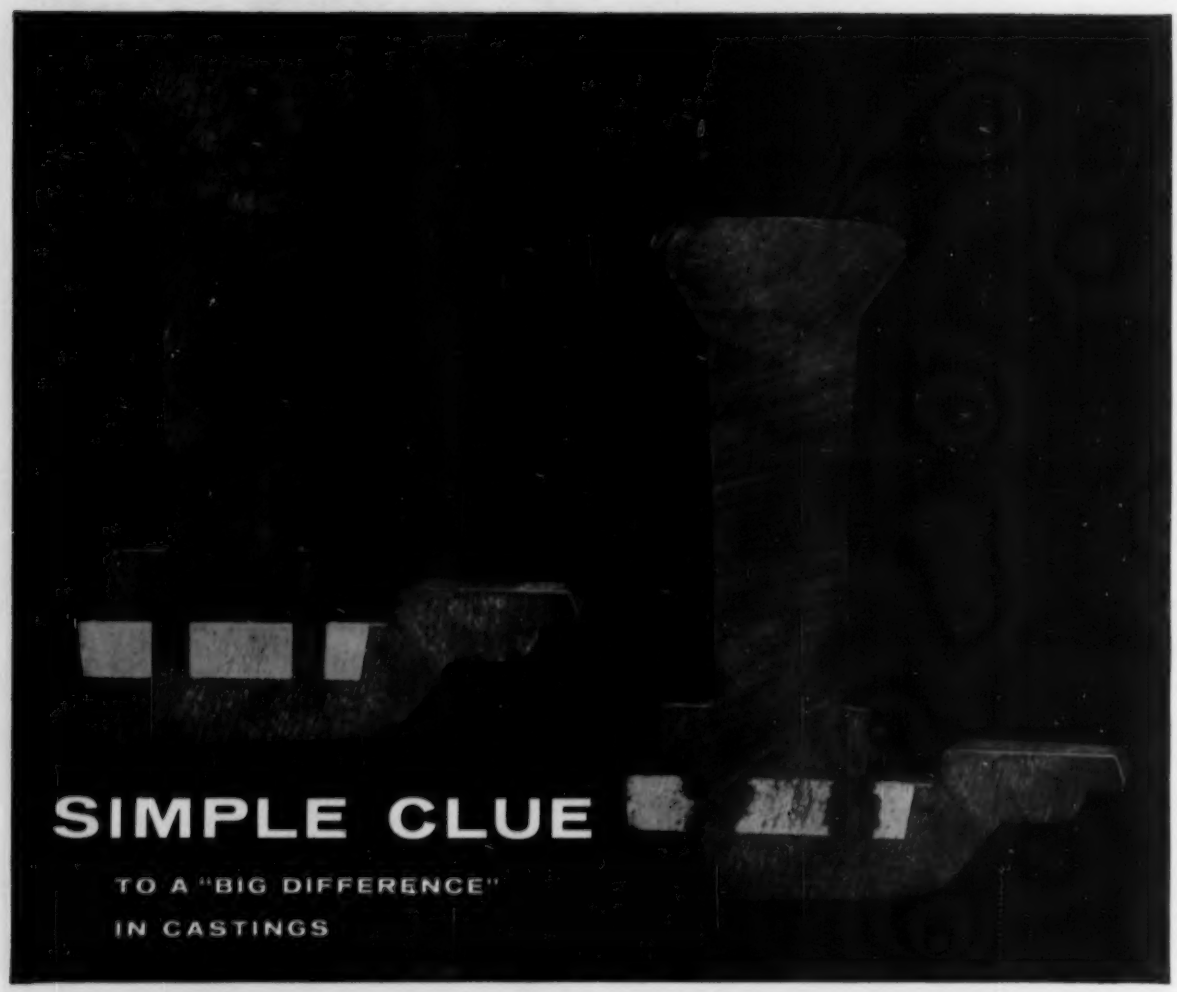
EASTERN CLAY PRODUCTS DEPT.

INTERNATIONAL MINERALS & CHEMICAL CORPORATION

General Offices: 20 North Wacker Drive, Chicago, 6

DIXIE BOND • BLACK HILLS BENTONITE • TRIPLACT • REVIVO CORE PASTE • REVIVO BOND • BONDACTOR • CUPOLINE • DURA PRODUCTS • WESTONITE

For more facts, circle No. 522 on postage-free Reader Service card on p. 17 or 18



If you are unhappy about your production . . . or your finished costs . . . we would suggest you cut a few sprue sections in two. You may be surprised at what you find.

If you're now using sand strainer cores, we'll bet you find ample evidence of erosion. And it's possible that, even with refractory cores, you'll find some disintegration has taken place.

For all refractory cores are *not* alike, and *Louthan* cores are *proved* to withstand 3,000°F. temperatures without spalling or disintegrating. This is important as it assures closer control of the molten metal, assures that no slag can get through to ruin a casting, saves needless grinding and inspection.

Louthan developed and perfected refractory strainer cores and maintains the highest standards in their production. You'll find them consistently uniform, dimensionally accurate, inexpensive to use and easy to handle. Why not give them a trial in your shop? Write today for full particulars and samples!

Louthan **REFRACTORY STRAINER CORES**

Louthan Mfg. Co., East Liverpool, Ohio (Subsidiary of FERRO Corporation)

REPRESENTATIVES: FREDERIC B. STEVENS, INC., 1800 18th St., DETROIT 16, MICH.; 93 Stone St., BUFFALO, N. Y.; 36 Shelby St., INDIANAPOLIS 7, IND.; P. O. Box 1716, NEW HAVEN, CONN.; 41 Dovercourt, TORONTO 1, ONT., CAN.; 1262 McDougall St., WINDSOR, ONT., CAN. FOUNDRY SUPPLY CO., 5009 Excelsior Blvd., MINNEAPOLIS 16, MINN.

For more facts, circle No. 516 on postage-free Reader Service card on p. 17 or 18

OREFRACTION

ZIRCON

SAND AND FLOUR

For Foundry Practice—

- DOMESTIC & AUSTRALIAN ZIRCON FOUNDRY SANDS
- ZIRCON FOUNDRY FLOURS IN 200 AND 400 MESH PARTICLE SIZES

from Orefraction Inc., a large and leading American processor of Zircon ores.

Orefraction Inc.

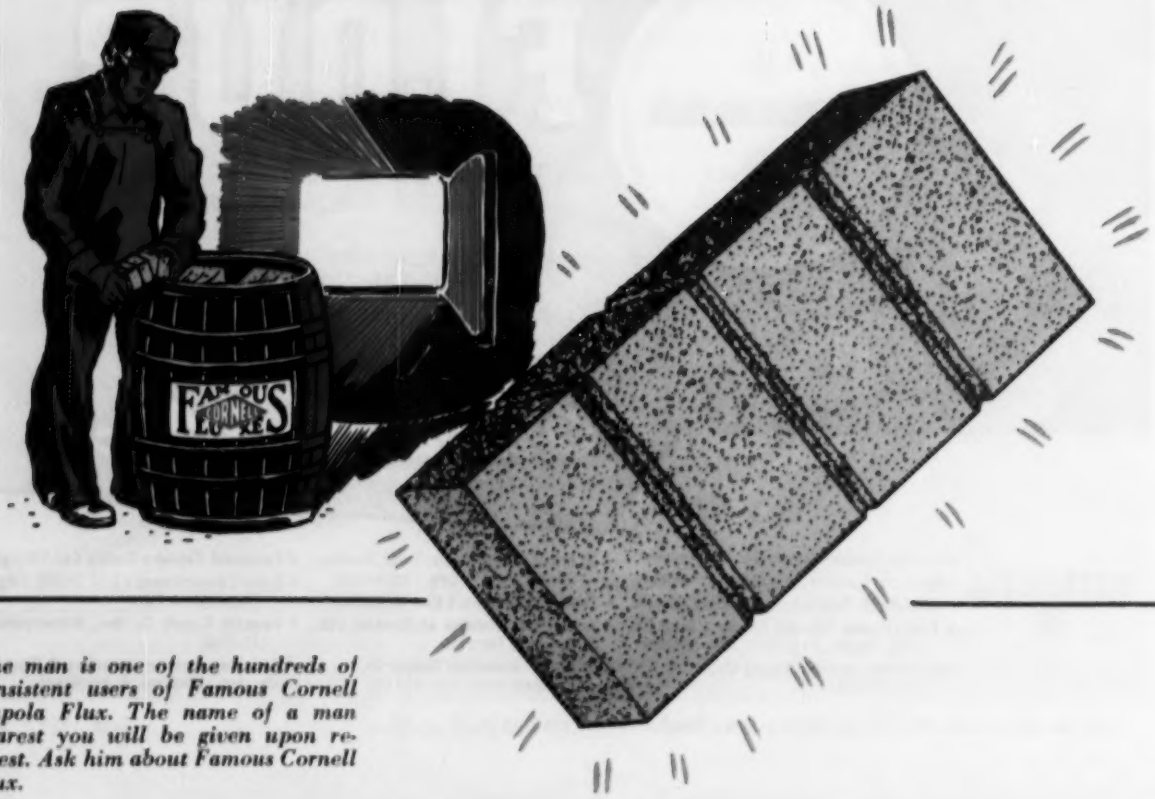
7425 THOMAS ST., PITTSBURGH 8, PA.

DISTRIBUTED BY

- Barker Foundry Supply Co., Los Angeles
- Hoffman Foundry Supply Co., Cleveland
- Frederic B. Stevens, Inc., Detroit; Buffalo
- Pennsylvania Foundry Supply & Sand Co., Philadelphia; New York; New England
- Industrial Foundry Supply Co., San Francisco
- M. A. Bell Co., St. Louis; Tulsa; Houston; Denver, Fred McGee, Chattanooga
- Frederick Engineers Co., Milwaukee
- Frederic B. Stevens of Canada, Ltd., Windsor; Toronto
- LaBrant Industrial Supply Co., Portland, Ore.
- Foremost Foundry Supply Co., Chicago
- Export Department: 1010 Schaff Bldg. Philadelphia, Pa.
- Foundry Supply Co. Inc., Minneapolis; St. Paul
- Canadian Foundry Supplies & Equip. Co., Inc., Montreal; E. Maritimes

*Ask the man**

IF *Famous* CORNELL CUPOLA FLUX IS ALL WE CLAIM IT IS . . .



**The man is one of the hundreds of consistent users of Famous Cornell Cupola Flux. The name of a man nearest you will be given upon request. Ask him about Famous Cornell Flux.*

*Ask the man**

CLEANER METAL CASTINGS HAVE GREATER TENSILE STRENGTH

For 38 years, Famous Cornell Cupola Flux has been making cleaner metal for gray iron foundries throughout the country. Castings from clean metal are uniformly hard throughout directly contributing to their greater tensile strength.

INCREASES SLAG FLOW OFF

Famous Cornell Flux is a scientifically made combination of high-grade fluorspar and many other materials which create a chemical reaction in molten iron greatly increasing slag flow off. By increasing slag flow off, drops are cleaner.

REDUCES DIGGING OUT TIME

By increasing slag flow off, Famous Cornell Cupola Flux assures cleaner drops. Digging out time is cut to a minimum and bridging over is practically eliminated.

Call a Cornell Flux Engineer. Ready to serve you are our engineers with long years of experience in foundries. Call on them today or write for Bulletin 46-B.

8 Advantages of Famous CORNELL

Aluminum and Brass Flux

- Makes metal pure and clean.
- Permits use of more scrap without danger of dirt, porous places or spongy spots.
- Thinner, yet stronger sections can be poured.
- Metal does not cling to the dross.
- Crucible or furnace linings are kept clean and preserved.
- Cleanses molten brass even when the dirtiest brass turnings or sweepings are used.
- Saves considerable tin and other metals.
- Forms a perfect covering over the metal during melting, prevents oxidation and reduces obnoxious gases to a great extent.

Write for Bulletin 46-A

The CLEVELAND FLUX Company

1026-40 MAIN AVENUE, N. W. • CLEVELAND 13, OHIO

Manufacturers of Iron, Semi-Steel, Malleable, Brass, Bronze, Aluminum and Ladle Fluxes—Since 1918

FAMOUS CORNELL FLUXES

Trade Mark Reg. U.S. Pat. Off.

. . . AND GET *More* PERFECT CASTINGS

DELTA Z-KOAT and ZZ-KOAT Washes are easy to mix and easier to apply. After mixing, there is no danger of precipitation and, when dried, they are completely moisture-proof. Applied by swabbing, dipping or brushing, they adhere uniformly to the sand and produce smooth, highly-refractory surfaces.

Both DELTA Z-KOAT and ZZ-KOAT Washes have unusually high fusion points and, because of their high heat conductivity, provide a more rapid surface-metal set. Both washes are economical to use.

DELTA Z-KOAT contains zirconium plus other high fusion refractories and DELTA ZZ-KOAT is an all-zirconium type wash.

DELTA

Working samples and complete literature on Delta Foundry Products will be sent to you on request for test purposes in your own foundry.

DELTA OIL PRODUCTS CO.

MANUFACTURERS OF SCIENTIFICALLY CONTROLLED FOUNDRY PRODUCTS

MILWAUKEE 9, WISCONSIN

For more facts, circle No. 511 on postage-free Reader Service card on p. 17 or 18

Do you really know your foundry production costs?

There *is* a practical way to compare your cost figures with the most progressive foundries in your area . . . to put your breakdown of departmental costs next to theirs to see where you may be out of line. Of course, identities are not necessary, so they are not revealed. Begin now to learn the up-to-date methods others have used to bring production costs more in line.

You can do this by joining a *Local Cost Group* sponsored by the Gray Iron Founders' Society. Progressive gray iron foundries are associated through 19 of these groups which meet quarterly in industry centers throughout the United States.

Regional cost consultants manage respective area cost groups and serve as your confidential C. P. A. on costs. For full information, check the coupon below and mail it to the Society immediately.

HOW TO OBTAIN ACCURATE JOB COSTS

Job costs for operating a sandslinger, roll-over, core-blower and other modern equipment must be figured differently than when these were hand operations. If you are still using simplified job cost methods after acquiring such modern equipment, your cost figures may be inaccurate.

To learn the most advanced cost methods, you should have a copy of the new *Cost Manual No. 2*, developed by a committee of foundry executives. Every foundry, large or small, will discover in this practical manual an easy and accurate way of bringing accounting practice up to date. This new manual describes *advanced cost methods* for gray iron foundries, and it also includes as a supplement the *basic cost system* as presented in *Cost Manual No. 1*. The coupon below is for your convenience.

GRAY IRON FOUNDERS' SOCIETY

Make it better with Gray Iron

GRAY IRON FOUNDERS' SOCIETY, INC.
National City-East 6th Building, Cleveland 14, Ohio

Please send us:

- ☐ Literature on *Cost Manual No. 2*.
- ☐ Full information about the nearest Local Cost Group.
- ☐ Complete facts about other Society services.

Name _____

Address _____

Title _____

Company _____

Foundrymen in the News

Herbert S. Hersey, president of C. O. Bartlett and Snow Co., Cleveland, has been elected president of Grindle Corp., Harvey, Ill., to fill the vacancy caused by the death of Aubrey J. Grindle, founder of the corporation bearing his name. Mr. Hersey will be assisted by present members of Grindle Corp. and by **C. J. Neville,** executive vice-president and treasurer of Bartlett and Snow, who will act as an associate. Mr. Hersey will continue with Bartlett and Snow in his present capacity. He is active in AFS, and for the years 1938 and 1939, Mr. Hersey served as president of Foundry Equipment Manufacturers Association, and in 1945 was president of the Conveyor Equipment Manufacturers Association.

F. S. Brewster, formerly vice-president and general manager of Harry W. Dietert Co., Detroit, has been appointed foundry consultant for Brumley-Donaldson Co., Los Angeles. After leaving Harry W. Dietert Co., he was engaged in establishing a quality control program for South Gate Aluminum & Magnesium Co. at their Southern California plant. Mr. Brewster is the national chairman of the AFS Sand Div.

Paul von Colditz, formerly assistant foundry superintendent, has been promoted to the position of assistant plant manager of the Steel Foundry Div., Canadian Car & Foundry Co., Ltd., Montreal, Quebec.

Richard A. Schaus has been named manager of induction and miscellaneous equipment engineering for Industrial Heating Dept., General Electric Co. Mr. Schaus was recently engaged in reactor development at the company's Knolls Atomic Power Laboratory in Schenectady.

William D. Gilder has been appointed chief metallurgist with the Reed Roller Bit Co. of Houston, Texas. He was last associated with the Weatherhead Co. of Cleveland as chief metallurgist.

A. J. Van Horn has been named general manager of Grindle Corp. and to fill the vacancy on the board of directors caused by the death of president A. J. Grindle. He will have **J. Donaldson** and **C. H. Vennetti** as his sales, engineering, and financial assistants. **J. H. Gougler,** executive vice-president, will head the Engineering Dept., and **L. W. Olson** will be in charge of purchasing and estimating.

Dr. John Chipman, head of the Dept. of Metallurgy at Massachusetts Institute of Technology, has been awarded the Bessemer Gold Medal for 1955, England's highest award for outstanding achievement in the science of metallurgy. The citation naming Dr. Chipman states that the award was made in recognition of his distinguished contribution to the knowledge of the physical chemistry of steelmaking.

William G. Connor, Jr., resigned as vice-president in charge of production of Walworth Co.

Charles B. Sanborn has joined the Electroplating Section of the Development and Research Div., International Nickel Co., Inc., New York. Mr. Sanborn was formerly associated with Graham Crowley & Associates, Inc., Chicago, Sherwin-Williams Co., and American Steel & Wire Co.

C. Davis Blackwelder, a vice-president of Reynolds Metals Co., has been appointed consulting engineer for the Operations Div. of the company and will have his office in the Reynolds Building in Richmond, Va. **Durwood J. Hedgecock,** division staff engineer, has been appointed chief engineer of Reynolds Metals Co.

M. W. Ohman has been appointed to the post of technical assistant in the sales department of Lithium Corp. of America, Minneapolis. He was formerly a sales engineer with the Haynes Stellite Co., of Kokomo, Ind.

F. S. Brewster. . . consultant

Charles Bultman, Detroit district sales manager of Pangborn Corp., has left that position for the Field Sales Dept. where he will assume responsibility for promotion of sales of new blast equipment, primarily sheet and plate blast machines. **David Bair** has succeeded Mr. Bultman as manager of the Detroit district. **Robert Treglown,** formerly of Ford Motor Co., is now a sales engineer in the Detroit district, and **C. H. McKinsey,** a veteran of 29 years of service with Pangborn, has been promoted from service engineer to sales engineer in the Detroit office. **James G. Richeson** has been appointed sales engineer and assistant to district manager E. C. Gilmour in St. Louis and Kansas City.

E. O. Mitchell has been appointed purchasing agent of Chicago Pump Co. **J. Zelenietz,** formerly pump application engineer, will become asst. purchasing agent.

E. G. Novotny has been appointed assistant purchasing agent for the Chattanooga, Tenn., plants of Combustion Engineering, Inc.

Aaron E. Hess, formerly vice-president and sales manager of Lancaster Malleable Castings Co., Lancaster, Pa., has been elected executive vice-president and general manager and **Richard G. Hess** was elected vice-president and sales manager.

continued on page 34

A. J. Van Horn. . . gen. mgr.

H. S. Hersey. . . heads Grindle

Dr. J. Chipman . . . honored

P. von Colditz. . . plant mgr.

PREMIUM PERFORMANCE BRINGS COSTS DOWN!

WHEELABRATOR® STEEL SHOT

COSTS 62% LESS

at HOOSIER IRON WORKS

MAINTENANCE COSTS ARE SLASHED, TOO

Abrasive costs per ton of castings cleaned were slashed from 75c to only 28c when Hoosier Iron Works, Kokomo, Ind., switched to Wheelabrator Steel Shot.

An additional saving was effected in the 15% to 33% longer life of wearable machine parts.

Manufactured under rigid control every step of the way, this premium electric furnace steel shot is made tough, hard and uniformly round. These properties make Wheelabrator Steel Shot last much longer, reducing abrasive costs. These same properties cut maintenance costs because they eliminate excessive machine-parts wear from sharp edges of broken shot.

Write for Bulletin 89B.

PERFORMANCE AT HOOSIER IRON WORKS

ABRASIVE	Chilled Iron Shot and Grit	Wheelabrator Steel Shot
Tons of Castings Cleaned	1018	1078
Pounds of Abrasive Consumed	13,400	2450
Cost of Abrasive Per Wheel Hour	$2.84	$1.07
Pounds of Abrasive Consumed Per Ton of Castings	13.2	2.3
Abrasive Cost Per Ton of Castings	75c	28c

note

Price alone does not determine cost. Although the original price of Wheelabrator Steel Shot is more than that of chilled iron its actual cost for Hoosier Iron Works is less than half. Premium performance brings costs down.

American **WHEELABRATOR®** *trail blazer of industrial progress*

AMERICAN WHEELABRATOR & EQUIPMENT CORP., 630 S. Byrkit St., Mishawaka, Indiana

For more facts, circle No. 520 on postage-free Reader Service card on p. 17 or 18

R. S. Stevenson . . . president

N. J. Henke . . . vice-pres.

C. E. Coulter . . . asst. mgr.

L. Lund . . . sales rep.

continued from page 32

Gordon P. Vega has been appointed manager of Commercial Research of Enterprise Engine & Machinery Co., a subsidiary of General Metals Corp., San Francisco.

Glenn Hughes of the Ohio Steel Foundry Co., has been sworn in as chief of the Castings Branch, Iron and Steel Div., Business and Defense Services Administration, Washington, D. C.

Fred C. Barbour, formerly with McWane Cast Iron Pipe Co., Birmingham, Ala., has been appointed metallurgical engineer of the Pig Iron Div., Republic Steel Corp., Cleveland.

Robert S. Stevenson has been elected president of Allis-Chalmers Manufacturing Co., Milwaukee. Stevenson has been executive vice-president of the company since July, 1952.

Norman J. Henke was elected vice-president and plant manager of the Fanner Manufacturing Co., Cleveland. Mr. Henke has been in charge of Fanner's chaplet and chill division sales for the past two years.

Charles E. Coulter has been appointed assistant sales manager of the Foundry Products Div., Archer-Daniels-Midland Co., Cleveland. Mr. Coulter has been with the company as sales representative in Chicago and Rock Island, Ill., since 1946.

Elmer E. Braun, formerly divisional manufacturing manager of the Central Foundry Div., General Motors Corp., has been promoted to divisional production manager. **Carl A. Koerner,** formerly plant manager of the Central Foundry Div., Defiance Plant, has been promoted to divisional manufacturing manager. **F. James McDonald,** formerly factory manager of Saginaw Malleable Iron Plant, has been promoted to plant manager of Central Foundry Div., Defiance Plant. **Charles E. Drury,** factory manager of the Central Foundry Div., Danville Plant, has been transferred to the Saginaw Malleable Iron Plant as factory manager. **Thomas E. Smith, III,** has been promoted from manufacturing superintendent to factory manager at the Danville Plant. **Robert H. Cowan** has been promoted from foundry superintendent to the position of manufacturing superintendent at the Danville Plant.

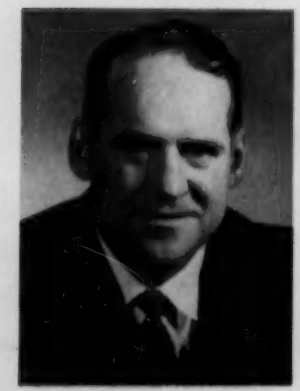
Louis Lund has been appointed sales representative of Foundry Products Div., Archer-Daniels-Midland Co., working out of their Rock Island, Ill., office.

W. E. Mahin, formerly technical director of Vanadium Corp. of America, has accepted the position of vice-president and director of research for the Hunter Engineering Co. at Riverside, Calif. His new address is: Hunter Engineering Co., 3236 Kansas Ave., Riverside, Calif.

continued on page 104

W. E. Mahin . . . with Hunter

F. C. Barbour . . . joins Republic



E. E. Braun . . . prod. mgr.

C. A. Koerner . . . mfg. mgr.

F. J. McDonald . . . plant mgr.

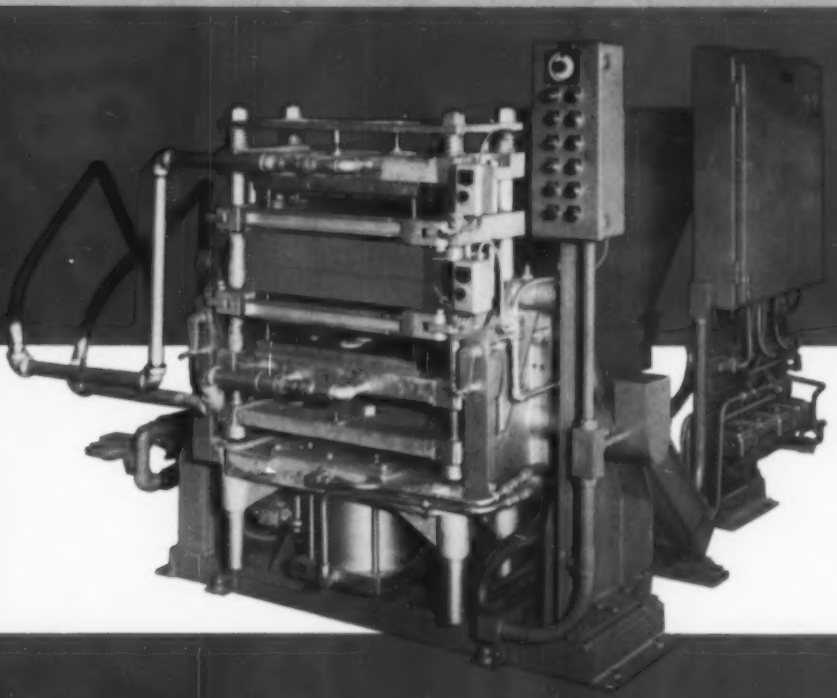
C. E. Drury . . . factory mgr.

SUTTER

—New—

AUTOMATIC SHELL CORE BLOWER

Gives 50-90 Cycles per Hour



This machine uses neated, split core or mold boxes. Heat to each half is independently controlled. Each section contains stripper pins and plates. Operator's only function is to remove baked cores from the open section of the box.

SUTTER SP-1300

AUTOMATIC SHELL CORE AND SHELL MOLD BLOWING MACHINE

Maximum Box Size—
14" x 24" x 7"

Maximum Draw—3½"

Now, a completely automatic machine that produces smooth, precision shell cores and shell molds, fully cured, at the astounding rate of 50-90 cycles per hour . . . the new Sutter SP-1300. Ample size of this unit permits the use of large, multiple cavity boxes for blowing both solid and hollow cores.

With this machine costly core ovens and driers are eliminated, as are the operating costs of this space-taking equipment . . . there is no rehandling, less breakage . . . and the saving in man-hours is enormous. All of which adds up to more and better cores produced in less time at lower costs on the Sutter SP-1300.

Although only cores have been mentioned, the same advantages apply to shell mold blowing. This versatile, dual-purpose machine was designed to efficiently produce both.

If you want to know all the "whys and wherefores" of this process and equipment, drop us a line and ask for your free technical bulletin No. SP-1300.

DO-4084-455

Creators of foundry equipment with NEW productivity

LITHO IN U.S.A.

SUTTER

PRODUCTS COMPANY

2005 WESTWOOD AVE. • DEARBORN, MICHIGAN

Exclusive United States Sales Representative
FREDERIC B. STEVENS, INC. DETROIT 16, MICH.
Branches: Buffalo, Cleveland, Indianapolis, New Haven

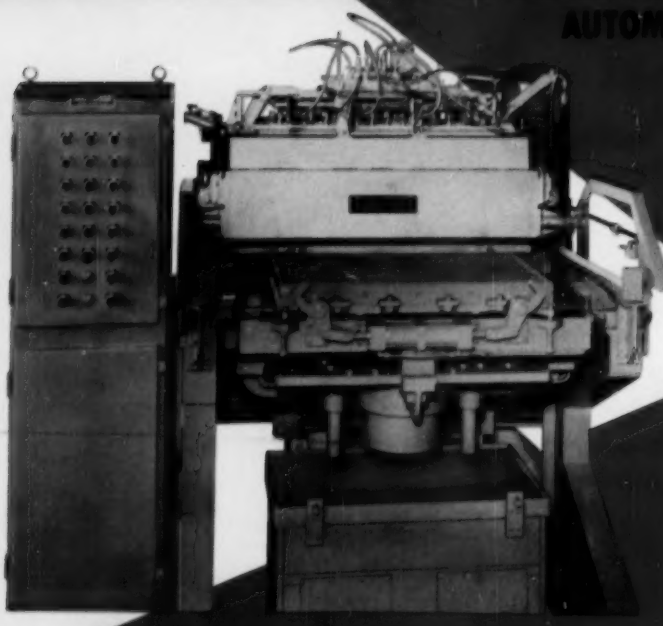
Exclusive Canadian and Overseas Manufacturer and Distributor
FOUNDRY EQUIPMENT LTD.
LEIGHTON BUZZARD, BEDFORDSHIRE, ENGLAND

—Now—

MEET PRODUCTION SCHEDULES ...LOWER PRODUCTION COSTS | AUTOMATICALLY

NEW, IMPROVED SUTTER SP-1100

AUTOMATIC SHELL MOLDING MACHINE



Maximum Mold Size—36" x 41" x 12" High. Pattern heated internally. Gas or Electrically Heated Oven.

featuring

new Larger, easily accessible resin bin

new Completely electrically controlled

new Faster, simpler adjustments for coating and curing time

plus All the Sutter advantages that have been proven in foundries throughout the world

Get your jobs out on time and save money doing it . . . a reality with the new, improved Sutter SP-1100.

Production is increased automatically because this machine automatically produces precision, high quality shell molds at an amazing rate of 40-50 cycles per hour. Production costs are reduced, too, because *one* unskilled operator can efficiently operate *two* Sutter Automatic Shell Molding Machines.

Knowing every job is different, Sutter has designed these machines with adjustable coating and curing times. You can quickly and easily select the proper time for most efficient operation . . . to maintain consistent high quality molds, regardless of the size or shape.

Too, every detail has been designed for economy. For example, pattern plates have integral stripper pins . . . reducing pattern costs, making it possible to change patterns faster. And, for short runs, you can utilize all of the pattern area by using Sutter quick change masks.

Naturally, only the finest materials are used in the careful construction of these units. You are sure of continuous day-after-day service . . . the same well-known Sutter dependability which has been proven in foundries all over the world.

Why not get all the facts? Send for your free Technical Bulletin No. 1100 today. It contains valuable information which shows how to meet foundry production schedules, how to lower costs—automatically.

Creators of foundry equipment with NEW productivity

SUTTER PRODUCTS COMPANY

2005 WESTWOOD AVE. • DEARBORN, MICHIGAN

Save 5 ways with pallet boxed shipments

VANCORAM BRAND

FERROCHROMIUM, FERROSILICON, FERROMANGANESE BRIQUETTES

Now— You can save time and money through...

1. EASIER HANDLING—Pallet boxes for Vancoram Briquettes and ferro alloys have been especially designed for safe, easy handling. Constructed of sturdy hard wood and tied with strong steel strapping—the chance of breakage is minimized.

2. MORE EFFICIENT STORAGE—The design and strength of Vancoram Pallet boxes permit safe multiple stacking indoors or out, which may not be feasible with more flimsy construction.

3. READY IDENTIFICATION — Pallet boxes of Vancoram Briquettes and ferro alloys are easily identified by the same plain marking and color-coding identification labels used on Vancoram Drums.

4. LESS CHANCE OF CONTAMINATION—Material confined to its own container rather than unwieldly bulk handling.

5. FASTER INVENTORY — Has the advantages of packed shipment in easy, quick inventory.

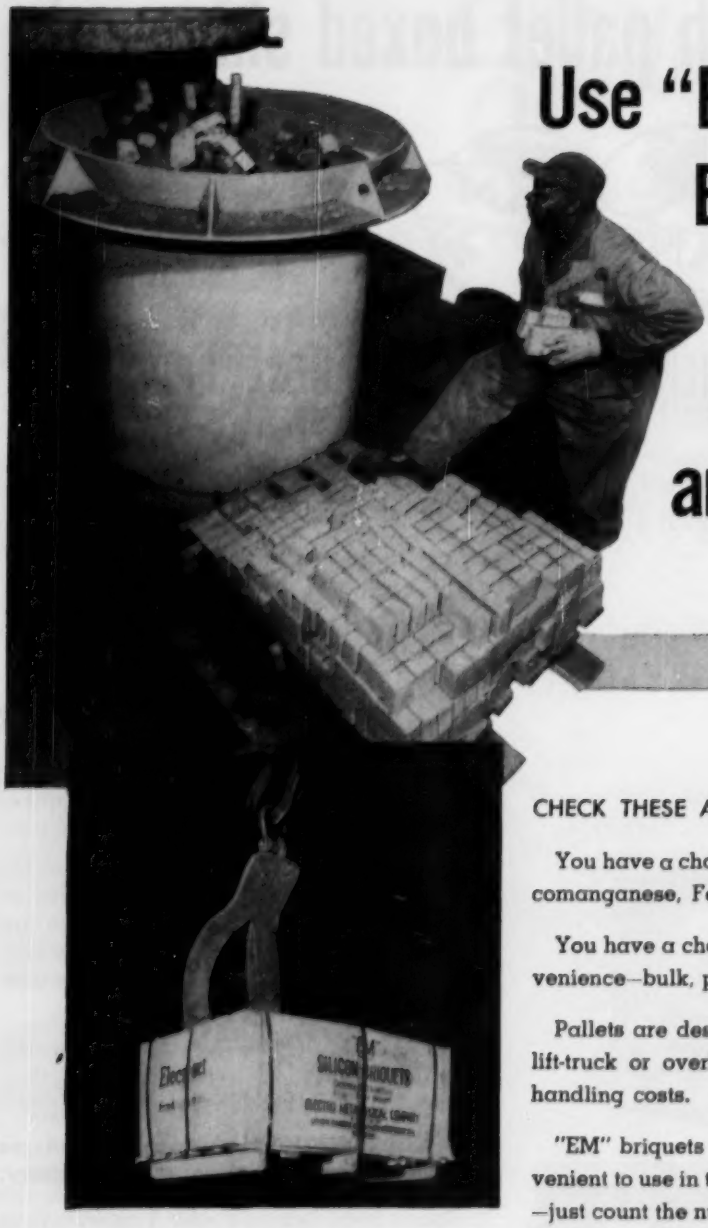
Besides briquettes, most other Vancoram ferro alloys are available in economical, easily-handled pallet boxes — another Vancoram service to you.

MAIL COUPON TODAY!

VANADIUM CORPORATION OF AMERICA
420 Lexington Ave., New York 17, N.Y.

GENTLEMEN: Please send me a copy of your color brochure giving a complete description of the advantages of Vancoram Palletized Shipments.

Name_____
Position_____
Company_____
Address_____
City_____ State_____



Use "EM" Ferro-Alloy Briquets for convenient charge make-up and easy handling

For additional information write or phone the ELECTROMET office nearest you.

CHECK THESE ADVANTAGES

You have a choice of 5 kinds of "EM" briquets—Silicon, Silicomanganese, Ferromanganese, Chromium, and Zirconium.

You have a choice of 3 kinds of shipments to suit your convenience—bulk, packed on pallets, or packed in 250-lb. bags.

Pallets are designed for fast, easy, and safe handling by lift-truck or overhead crane. Pallet shipments reduce your handling costs.

"EM" briquets are easy to handle in the foundry and convenient to use in the cupola charge. No weighing is necessary—just count the number of briquets to obtain the weight needed for the charge.

"EM" briquets are scientifically designed for maximum alloy recovery in cupola melting.

The terms "EM" and "Electromet" are trade-marks of Union Carbide and Carbon Corporation.

ELECTRO METALLURGICAL COMPANY
A Division of Union Carbide and Carbon Corporation
30 East 42nd Street UCC New York 17, N. Y.
OFFICES: Birmingham • Chicago • Cleveland • Detroit
Houston • Los Angeles • New York • Pittsburgh • San Francisco
In Canada: Electro Metallurgical Company, Division of Union Carbide Canada Limited, Welland, Ontario

Electromet
TRADE MARK
Ferro-Alloys and Metals

For more facts, circle No. 512 on postage-free Reader Service card on p. 17 or 18

Every Crack Has a Cause!

Inspection with MAGNAFLUX* at the *RIGHT* times

- Finds the Cause
- Suggests the Remedy
- Reduces Rejects
- SAVES YOU MONEY
- BUILDS NEW BUSINESS

Crack as revealed by Magnaflux in the end-bell casting on an electric motor. Crack is the result of improper handling.

Not *all* cracks are serious. It depends upon the type, size and location. But in the few areas where stress is high, even a tiny crack can be important, because it raises the stress still further.

The *right* time to find cracks is when they *first* occur. This may be anywhere from pilot run to handling for shipping. Wherever it is, sampling inspection with Magnaflux finds and clearly marks the defect to point to the cause.

By finding serious defects early in processing, you can determine *where* they occur and how to correct them — before parts are run in quantity and later rejected. Correction often involves only a minor change in design or feeding procedure, or in cleaning or handling, with each change checked by Magnaflux in pilot runs. This results in a production run with almost no rejection due to cracks. It leads to castings with even stress flow, that are cheaper to pour, lighter, stronger and better looking.

With RELIABLE castings cheap to make, many foundries that use inspection with Magnaflux are now selling castings where formerly more costly parts were used.

Find out now how inspection with Magnaflux can help you produce better castings, at lower cost to a bigger market! Ask to have a Magnaflux Engineer call and give you the facts.

*Magnaflux is a Registered Trademark of Magnaflux Corporation

MAGNAFLUX

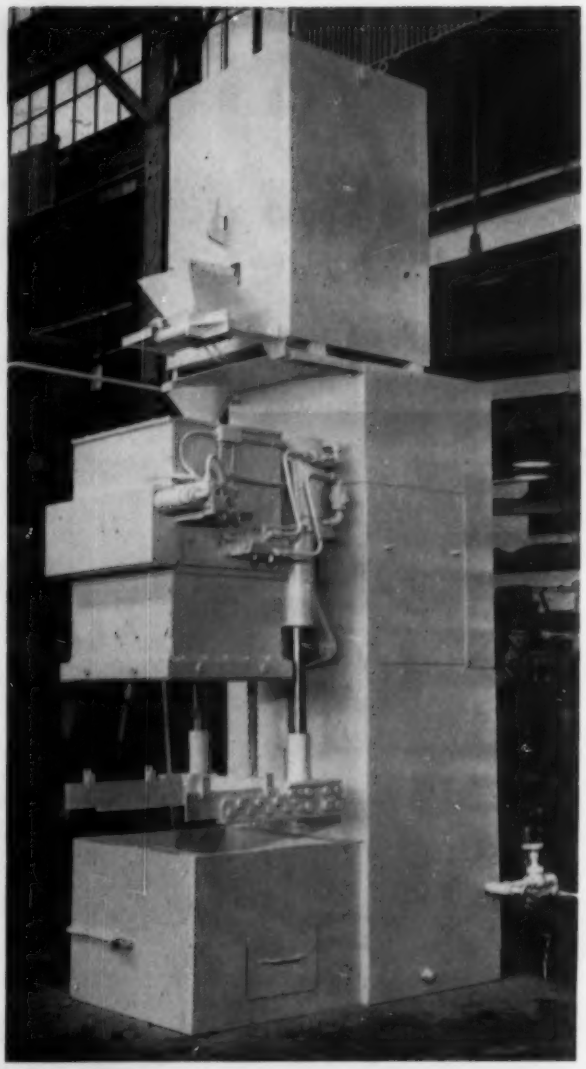
MAGNAFLUX CORPORATION

7352 West Lawrence Ave. • Chicago 31, Ill.

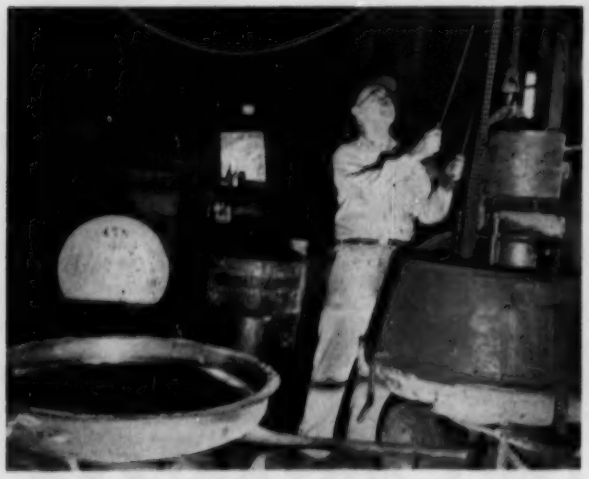
New York 36 • Pittsburgh 36 • Cleveland 15
Detroit 11 • Dallas 19 • Los Angeles 58

(ADVERTISEMENT)

New equipment that pays for itself through reduced costs



THIS FULLY AUTOMATIC SHELL INVESTMENT UNIT forms four or more perfect shells for patterns up to 24 x 30 inches in size each minute. It features precise investment time control, metered sand resin addition, controlled sand resin rainfall and thorough lamp scavenging. This shell investor may be installed individually and later combined in a complete rotary Formatic Unit. When installed individually and used with pattern dollies, it offers all of the control features so essential to shell molding. *Full information may be obtained by writing to Beardsley & Piper, 2424 N. Cicero, Chicago 39, Ill.*



ALL OF THIS FOUNDRY'S CORE SAND is prepared in this Model 3½ Mulbaro. At the Riverside Foundry, Chicago, Illinois, three barrows are used with a single mulling mechanism permitting full utilization of the Mulbaro's capacity. *For full information write to Beardsley & Piper, 2424 N. Cicero, Chicago 39, Ill.*

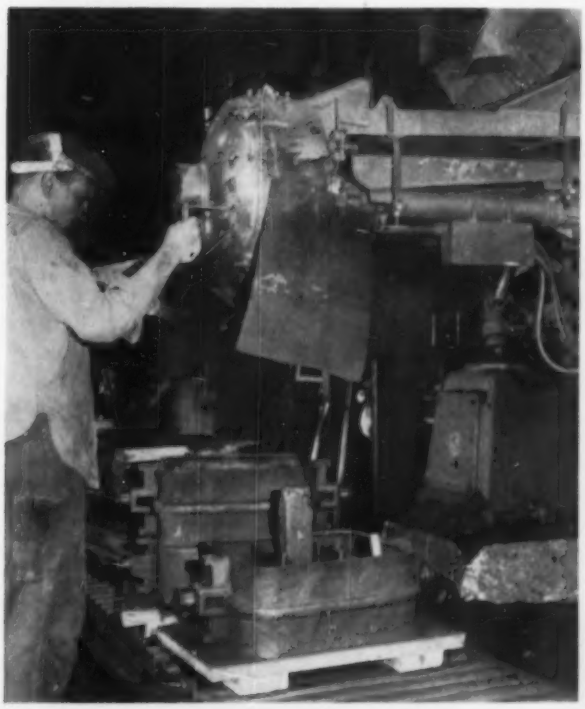
IN ONE OF THE BEST small core rooms in the country . . . the Midwest Foundry at Coldwater, Michigan, blows a great variety of miscellaneous cores on B&P Champion Core Blowers. A powered conveyor belt handles the output from eight Champion Blowers. *For full data write to Beardsley & Piper, 2424 N. Cicero, Chicago 39, Ill.*

For more facts, circle No. 508 on postage-free Reader Service card on p. 17 or 18

SKIPTROL CUTS COSTS in this gray iron foundry where two Skiptrol-equipped Speedmullor-Preparator units handle the preparation of molding sand. Skiptrol automatically controls the loading of the skiphoist bucket and stops the Preparator or loading belt when the bucket is full. *Full data may be obtained by writing to Beardsley & Piper, 2424 N. Cicero, Chicago 39, Ill.*

NO PITS were required for the installation of the new Model "60" Preparator which is a part of this "50-60" Speedmullor-Preparator unit at the Riverside Foundry, Chicago, Illinois. The "50" Speedmullor is platform-mounted to permit loading of the portable slinger tank at floor level. *Send for a free copy of the Riverside story; Beardsley & Piper, 2424 N. Cicero, Chicago 39, Ill.*

PERFECTLY RIDDLED CORE SAND is riddled directly onto the pattern by this B&P Roller Riddle at the Chemalloy Foundry, Louisiana, Missouri. The automatic Roller Riddle need only be positioned over the core box momentarily and the riddling job is completed. The core box is mounted on a J&J Jolt-Rol-A-Draw and the sand is Speedmullor-mulled. *Full data may be obtained by writing to Beardsley & Piper, 2424 N. Cicero, Chicago 39, Ill.*



THIS SANDSLINGER-CONVEYOR UNIT at the Lindgren Foundry, Batavia, Illinois, successfully handles the foundry's small and medium size work. With Slinger flexibility loose or mounted patterns of any height and of wood or metal construction may be handled with ease. A newly installed Speedmullor provides the mulled all-purpose sand for this operation. *Write for full information to Beardsley & Piper, 2424 N. Cicero, Chicago 39, Ill.*

FACT:
Without good bentonite your sand molds will produce costly REJECTS.
FACT:
NATIONAL BENTONITE is the Finest Quality Obtainable,
mined from the world's purest sources of bentonite . . . processed by the world's largest producers of bentonite.

It's a proved fact that the quality of bentonite you use in molding can determine the amount of money you lose by rejects. Try and save a few cents by using poorer quality bentonite and you may lose hundreds of dollars. Good bentonite is good insurance for your profits . . . and good bentonite means National Bentonite. Here's why:

National Bentonite is selected from only the finest types of bentonite in the world. It is processed with laboratory exactness so it is always the same, uniform high quality. It provides excellent mold durability, yields higher permeability, has good green strength, higher tensile strength, higher hot strength, and higher sintering point. Besides that, National Bentonite requires less water to bond, so reduces the amount of vapor to be vented. All points considered, National Bentonite offers you greater quality and better characteristics to make good sand molds. This is why scores of good foundrymen have specified National Bentonite for years.

Available from better foundry suppliers everywhere. Write or phone today for specifications and prices.

Baroid

Baroid Division ☆ National Lead Company
Bentonite Sales Office: Railway Exchange Building, Chicago 4, Illinois

For more facts, circle No. 509 on postage-free Reader Service card on p. 17 or 18

Talk of the Industry

EROSION RESISTANCE of sand to molten steel can be indicated, according to Wm. D. Emmett, general superintendent, Los Angeles Steel Casting Co., as follows: Affix a standard 2 x 2-in. sand test specimen to a rod as in the Caine Test, dip into a riser or other cooling metal to pick up a thin shell, then work up and down in ladle of hot metal until shell has melted. Look at the sand. Test duplicates action of steel which, on pouring into a mold, quickly forms a thin shell as it hits the cold sand. Shell then melts as hot metal flows over it. Sands that can't take it lead to rough surface and sand inclusions.

IT'S A VIBRATOR . . . it's a rammer . . . it's a pneumatic tool . . . and maybe more. Operated at usual plant pressures, it gives 40 times the energy at only 1/20 the air consumption, makes considerably less noise, and produces much lower wear and tear on equipment. It's based on a new conception of vibration and achieves high frequency by taking advantage of the harmonics of the fundamental frequency of the unit. Instead of numerous noise-producing impacts per second, it runs at less than 60 per minute and number is adjustable over a wide range. Seems it all started when someone needed a vibrator to loosen material caked on the walls of chemical processing equipment. Then it was applied to vibratory compacting of powdered ceramics and metals. Foundrymen who take a peek at it stay around for a long look.

SUDDEN DEMAND for metal due to unexpected high production requirements caught a foundry with no time to install additional cupolas. Existing equipment was already up to its limit until output was boosted by switching to a special, high-density coke. Now one cupola is doing more than two did previously. In addition, carbon control is better (± 0.05), castings at 229 Bhn machine as well as at 179 Bhn with the former practice, cost is lower, and fluidity is higher enabling foundry to use thinner gates which require no grinding after knocking off.

TOTAL EMBARGO of copper exports is not justifiable at this time, John C. Barton, director, Office of Export Supply, wired the Non-Ferrous Founders' Society in explaining that second-quarter cutback in copper scrap exports (from 6295 to 1667 short tons) caused hardships to the exporting trade and friendly foreign countries. Not mentioned, NFFS Secretary-Treasurer James W. Wolfe points out, are 7000 tons of copper-bearing brass and bronze scrap licensed for export. Export of copper-base and light metals scrap hits the castings industry hard because non-ferrous foundrymen are the biggest users of scrap as such or as refined in secondary ingot form. NFFS has urged repeatedly that all exports of both copper and aluminum alloy scrap be halted so non-ferrous foundries can recover markets exporting policies have taken from them.

CHILL TEST for quick check on iron composition tentatively standardized by ASTM in 1953 is getting a thorough going over by a committee under D. E. Krause, executive director, Gray Iron Research Institute, Columbus, Ohio. Needed are more specific recommendations for determining depth of chill. Persons interested in obtaining a chill-free casting tend to read high, while those interested in making castings with a chilled surface tend to read the chill low. Difficulty arises in part from mottled zone which covers area between "clear chill" and "total chill." Selection of specimen size so chill depth does not exceed twice the specimen thickness is one way to minimize mottled zone, get more accurate reading. Committee will also recommend that castings having chilled surface for wear resistance be governed by clear chill and that total chill also be measured if there is to be some machining near the chilled surface.

VERTICAL GATING SYSTEM tentatively recommended by the Light Metals Research Committee of the American Foundrymen's Society calls for a tapered sprue with enlargement at the base, a runner extension past the gate, side riser with a narrow web into the mold cavity, and a pop-off at the end of the runner extension. Developed by studying water flow in transparent molds and confirmed by test castings, the vertical system is expected to be as widely adopted as the previously recommended horizontal system that foundrymen have found so effective in pouring problem castings.

MONTHLY REPORT CARDS for superintendents, with extra dollars for good grades is a feature of a new incentive plan at Electro Refractories & Abrasives Corp., Buffalo, N. Y. Under the plan, separate from the incentive system for plant workers, superintendents get bonus payments for cutting costs and increasing production of grinding wheels, crucibles, and refractories. Each supervisor is allotted "premium units" which can be worth up to $75 apiece in bonuses. Monthly progress reports show superintendents how they are doing. Premium payments are made at the end of the year.

SALES TOOL relatively little used by foundries is an airplane but Empire Steel Castings, Inc., Reading, Pa., is convinced after one year and 200 flights that a company-owned plane has at least three major purposes: to interest potential customers and develop new business in new territories . . . to provide faster freight service in emergencies . . . to transport plant personnel for sales, service, and inspection at great savings in time. In addition to bringing customers to the foundry for inspection of production facilities and discussion of problems, the plane has cut delivery time on urgent work, and has brought in business from the South and Southwest. Besides developing business in distant areas, the plane makes routine trips every six months on customer courtesy calls.

NICKEL available to civilian industry is expected to be greater this year than in 1954 when government stockpiling and defense requirements took some 40 per cent of the total free world supply, according to Dr. John F. Thompson, board chairman of International Nickel Co. of Canada, Ltd. With free world supply at a record 390,000,000 lb and modification of stockpile demands probable, greater satisfaction of civilian needs will be possible, he told shareholders at the company's recent annual meeting. International Nickel feels a healthy nickel-consuming civilian industry is essential to adequate defense preparedness and views with concern attempts to eliminate nickel in new designs by engineers fearful that nickel will not be available.

/Herbert D. Scobie

For Efficient Quality Control
In Research and Production Applications

BAIRD ASSOCIATES DIRECT READER

The new Direct Reader is designed for a heavy-load quality control system requiring quantitative analysis of a large number of elements. Improved optical stability, precise monitoring and increased flexibility in spectrum line selection permit simultaneous precision analysis of as many as 18 elements present in less than one minute.
Request Bulletin 44

3-METER CONCAVE GRATING SPECTROGRAPH

Convenient operation combined with maximum resolution and high dispersion make the Baird Associates 3-Meter Concave Grating Spectrograph an essential instrument for production control and research analysis. This unit conveniently handles all types of spectrographic samples. It provides both qualitative and quantitative analysis of metallic elements.
Request Bulletin 52

SPECTROMET*

Baird Associates Spectromet* makes quality control analysis possible directly on the production floor. This comparatively low cost instrument handles a heavy work load, analyzing as many as six elements in ferrous and non-ferrous metals with speed and precision.
Request Bulletin 42

*Trade Mark

Baird Associates, Inc.
33 UNIVERSITY ROAD, CAMBRIDGE, MASS.

BAIRD ASSOCIATES, INC.
33 University Road
Cambridge 38, Mass.

Gentlemen:
Please send me Bulletin .....
Name .....
Address .....
City ..... State .....

59th AFS CONVENTION

news

Story

Bruce L. Simpson
AFS President

Frank W. Shipley
Vice-President

PRODUCTION techniques and design factors aimed at improving the competitive position of castings, along with management controls and cost problems highlighted the 59th Annual Convention of the American Foundrymen's Society in Houston, Texas, May 23-27. Featuring some 135 discussions and papers by nearly 200 authors and speakers, the 5-day convention covered the entire field of castings production.

Among recent developments described were pressure pouring of steel railroad car wheels in graphite molds, carbon dioxide process for hardening of cores and molds, properties and heat treatment of pearlitic malleable, a die-pressing process for cast iron, and injection methods for removing sulphur and increasing carbon in cast iron. Also high in interest were risering, casting design, applications of castings in railroad and aircraft, foundry education, research in sand, vertical gating, and malleable melting, and discussions and demonstrations on foundry ventilation and in-plant environmental control.

Papers by overseas authors from Scotland, England, Australia, Germany, and Switzerland were presented.

Rounding out the reports and discussions on new developments were the informal shop course and round table luncheon sessions set aside for reviews of practical shop problems. In addition to the 60 technical meetings, may AFS divisions and committees met to plan activities for the future and to lay groundwork for the 1956 AFS Convention.

Traditional Convention social events combined with plant visits and Texas hospitality to give foundrymen and their ladies a pleasant, busy, informative week.

Presiding at official functions throughout the week was AFS President Frank J. Dost, Sterling Foundry Co., Wellington, Ohio. At the annual business meeting the morning of Wednesday, May 25, President Dost stressed the significance of technical committees in the Society's function of creating, assembling, and disseminating information to the castings industry. He invited foundrymen to volunteer for committee service.

Referring to the $50,000 Pangborn grant for scholarships, he stated that deeds of grant have been drawn up and said that details of scholarships to be administered by AFS chapters will be announced in the fall.

AMERICAN FOUNDRYMAN has been renamed MODERN CASTINGS in recognition of castings industry advances and the part the magazine has played in portraying them, Mr. Dost said. A number of changes are planned, he indicated, and he invited the industry to express its opinions of MODERN CASTINGS after seeing the "new look" in July.

AFS is walking a financial tightrope, Dost declared, with biennial lows in income. The Society must either

More than 1000 plates were filled at the Texas Chapter Night Barbecue. Inset . . . AFS President Frank J. Dost (left), Sterling Foundry Co., Wellington, Ohio, receives badge signifying membership in sheriff's posse.

Past President Collins L. Carter presiding at the Alumni Dinner.

reduce its activities to a level consistent with monies available or find other income to carry on a growing program of service to the castings industry, he said.

Officers and new directors who took office the day following the close of the Convention were announced by General Manager Wm. W. Maloney (this issue, pages 50-51). Incoming president is Bruce L. Simpson, National Engineering Co., Chicago, vice-president of the Society during the past year. New vice-president is Frank W. Shipley, Caterpillar Tractor Co., Peoria, Ill., a past national director of AFS.

Prior to presentation of awards and certificates to the five top prize winners in this year's apprentice contest by President Dost, Wm. J. Hebard, Continental Foundry & Machine Co., East Chicago, Ind., chairman of the AFS Educational Div., cited the work of the competitors in the 32nd Annual AFS Apprentice Contest (pages 66-67) and indicated that the Society was stepping up its educational activities.

In his Charles Edgar Hoyt Memorial Lecture following the close of the business meeting, Fred J. Walls, International Nickel Co., Detroit, added two R's—Respect and Responsibility—to the traditional three associated with education.

The castings industry needs an increasing number of highly trained and skilled people to insure the growth of the castings industry, he said, and this can be assured with proper education. Foundrymen can assist themselves by showing interest in educators and educational programs, by encouraging young men to consider a career in the castings industry, and by supporting better schools.

Mr. Walls cited the efforts of AFS in the field of education, pointing out that the organization now has a full-time staff educational director. He commended the Foundry Educational Foundation for its work over the past eight years in increasing interest in and quality of foundry instruction in engineering schools. Commenting on public relations aspects of the castings industry, he suggested that foundries of the future be considered casting plants or casting shops to avoid the unfavorable implication the public associates with the traditional designation for a castings production operation.

As a memento of his lecture, Mr. Walls received a certificate and a motion picture camera which were presented by R. F. Thomson, Research Laboratories Div., General Motors Corp., Detroit, chairman of the Annual Lecture Committee.

At the annual banquet, achievements in foundry technology and service to the industry were recognized through presentation of AFS Gold Metals and Honorary Life Memberships. Presentation of the following awards was made by Mr. Walls as chairman of the Board of Awards:

John B. Caine, consultant, Wyoming, Ohio—J. H. Whiting Gold Medal *"for outstanding contributions to the Society and the industry, particularly in the field of foundry sand research and applications."*

John Edward Rehder, director of technology and research, Canada Iron Foundries, Montreal, Que.—Peter L. Simpson Gold Medal *"for outstanding contributions to the Society and to foundry knowledge of cast metals."*

Robert F. Thomson, head of metallurgy, Research Laboratories Div., General Motors Corp., Detroit—John A. Penton Gold Medal *"for outstanding contributions to the Society and the industry in foundry research, particularly in the field of light metals."*

Honorary Life Memberships were presented to:

Frank C. Riecks, technical assistant to the manager of foundries, Ford Motor Co., Dearborn, Mich.—*"for outstanding contributions to the Society in the design and construction of the new AFS headquarters building."*

Albert F. Pfeiffer, superintendent of pattern shops, Allis-Chalmers Mfg. Co., Milwaukee—*"for contributions to the Society, its chapters, and the industry over many years; for better understanding of patterns and their importance in foundry work; and for his constant encouragement of young men to enter the industry."*

Frank J. Dost, president, Sterling Foundry Co., Wellington, Ohio—*"for outstanding service to the Society as president during the year 1954-55."*

Banquet address entitled *"The New South"* was presented by Hugh M. Comer, board chairman, Avondale Mills, Sylacauga, Ala. What you have to sell, you have

Alumni Dinner speaker was C. C. Chambers, Texas Foundries, Inc., Lufkin, Texas.

Announcing election of officers at Annual Meeting is AFS General Manager Wm. W. Maloney.

Retiring President Frank J. Dost delivering Presidential Address at Annual Business Meeting.

to *sell*, he pointed out in reviewing the natural and human resources of the South. He may well have had the entire castings industry, which traditionally has a let-'em-buy instead of a go-sell-'em attitude in mind in emphasizing the importance of selling.

Texas Chapter Night, May 26, treated Convention-goers to an evening of Western entertainment featuring a chuck wagon barbecue, cowboy music and entertainment, and a mounted drill and precision riding by the Harris County Sheriff's Posse. During the evening the "sheriff," thinking he recognized several suspicious characters in the audience, "arrested" and "jailed" ????

Social activities started the day before the Convention opened with the President's reception honoring Texas Chapter officers, directors, and Convention committee workers. The following day a special program for the ladies began with the AFS Tea at which the Society played host. Other ladies activities included a tour of Houston, a visit to the University of Houston and to San Jacinto Battleground, a trip to Galveston, a cruise on the Houston Ship Channel, and a luncheon and fashion show.

Past and present officers and directors, nominees, and recipients of Gold Medals and Honorary Life Memberships met at the AFS Alumni Dinner to hear C. C. Chambers, Texas Foundries, Inc., Lufkin, speak on *"Human Relations in the Foundry Industry."*

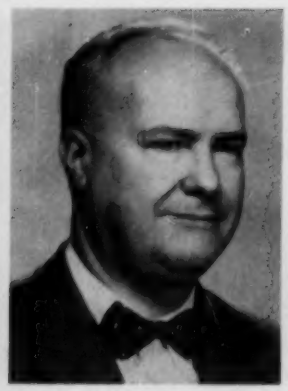
Decrying attempts to drive a wedge of misunderstanding and distrust between the front office and the foundry, Col. Chambers reported on a survey he had conducted to determine what contributes most to good employee relations. He listed the major factors as: company character, personal recognition for employees, continuous communication between employees and management, and selection, assignment, and training. Turning to management compensation he described a cost reduction incentive plan.

Traditional Past Presidents' Breakfast was attended by L. N. Shannon (1940-41), Walter L. Seelbach (1951-52), Collins L. Carter (1953-54), Herbert S. Simpson

Left . . R. F. Thomson, Annual Lecture Committee chairman, presents certificate and movie camera to Fred J. Walls on completion of Hoyt Memorial Lecture following Annual Business Meeting.

Above . . Walls, as Awards Chairman, turned tables at Annual Banquet when he presented AFS Gold Medals to Thomson, J. B. Caine (second from right), and J. E. Rehder.

C. W. Gilchrist



Charles E. Nelson

O. Jay Myers

Richard A. Oster

AFS Officers and Directors

New officers and directors of American Foundrymen's Society were elected at the Annual Business Meeting held May 25, during the Convention at Houston, Texas. They will take office the day following the close of the week-long Convention.

President

Bruce L. Simpson, president, National Engineering Co., and National Dust Collector Corp., both of Chicago, was elected president of AFS for the 1955-56 term. Born in Chicago, he attended public schools in Evanston, Ill.; Hobart College, Geneva, N. Y., and Northwestern University Law School. Admitted to Illinois State Bar, 1937; lawyer at Ashcraft & Ashcraft, Chicago. Entered National Engineering Co. in production department; was production manager, process sales, vice-president and in 1943, president. Has served as secretary treasurer and director of the Chicago Chapter and was a director of F.E.M.A.

Vice-President

Frank W. Shipley, foundry manager, Caterpillar Tractor Co., Peoria, Ill. Born in Disko, Ind., attended the School of Chemical Engineering, Purdue University. Worked at Studebaker Corp., South Bend, in the chemical laboratories and later as chemist in the foundry; went to Lakey Foundry & Machine Co., Muskegon, Mich., as chief metallurgist; joined Fairbanks Morse Co., Beloit, Wis., as foundry metallurgist, and joined Caterpillar Tractor Co., in the same capacity. Became foundry superintendent, assistant foundry manager and foundry manager. Served on a number of AFS committees and was a member of the Board of Directors from 1950 to 1953. Also served as chairman of the Central Illinois Chapter.

Directors, Three Years

C. W. Gilchrist, foundry superintendent, Cooper-Bessemer Corp., Mt. Vernon, Ohio. Graduated from Tri-State College, Angola, Ind., with B.S. in Chemical Engineering. Chemist and assistant metallurgist at Cooper-Bessemer, Grove City; set up foundry control laboratory, Cooper-Bessemer, Mt. Vernon; with United States Air Force, 1941-46, emerging as Lt. Colonel. Foundry engineer at Cooper; assistant foundry superintendent, and superintendent of foundry.

Charles E. Nelson, technical director, Magnesium Div., Dow Chemical Co., Midland, Mich. Graduated from Alma College, Alma, Mich.; joined Chevrolet Motors Co., Flint, Mich., as metallurgical chemist; E. I. duPont, Wilmington, Del., research chemist, and Dow Chemical as research metallurgist. Became chief of metallurgical staff, assistant director of metallurgical research, and technical director, Magnesium Div. Has served on several AFS committees and is a member of A.I.M.E., A.S.M., and American Chemical Society. Presented the Hoyt Lecture in 1948.

O. Jay Myers, technical director, Foundry Products Div., Archer-Daniels-Midland Co., Minneapolis, Minn. Born in New York, he received his A.B. from Princeton University, was awarded a master's degree in geological engineering, and degree of Engineer of Mines by Colorado School of Mines. Joined American Smelting & Refining Co. as assistant geologist; Wright Aeronautical Corp., Lockland, Ohio, as director of foundry practice and now his present post with ADM.

(1941-42), Dan M. Avey (1934-35-36), I. R. Wagner (1952-53), Ralph J. Teetor (1944-45), W. B. Wallis (1948-49), Fred J. Walls (1945-46), H. Bornstein (1937-38), and R. E. Kennedy, secretary emeritus.

When not attending Convention sessions, foundrymen visited plants and shops in the Houston area where they viewed foundry equipment and processes, including the CO_2 method of hardening cores.

Breakfasts for authors and session officers were held the morning of the first three days to arrange last minute details of meetings and to maintain AFS program standards.

Part of the Convention technical program is reported below, balance will appear in the July issue.

Foundry Costs

Management Task in a Competitive Economy, L. L. Ellis, Booz, Allen & Hamilton, Chicago. Skilled executive ability is the scarcest commodity in the country today. Most important reasons are: rapid expansion

Curtis C. Drake

Robert W. Trimble

Harold C. Erskine

Frank J. Dost

Elected at Annual Meeting

Was chairman of Twin-City Chapter and is vice chairman of AFS Sand Division and active on six technical committees in the division. Holds membership in A.I.M.E. and French Foundry Association.

Richard A. Oster, director, Beloit Vocational & Adult School, Beloit, Wis. Born in Rockford, Ill.; attended Milwaukee State Teachers College; graduated from Milwaukee School of Engineering; graduated from Stout Institute with B.S. degree, and did graduate work at College of Education, University of Wisconsin. Joined Compressed Industrial Gases, Milwaukee, as welding technician; Research & Development Dept., National Cylinder Gases, Chicago, as industrial engineer; was instructor of metallurgy and heat treating at West Allis Vocational and Adult School. Appointed trade and industrial coordinator of Beloit Vocational & Adult School; was co-chairman of apprenticeship contest for Northern Illinois-Southern Wisconsin Chapter, and was director and secretary of the chapter. Became director of Beloit Vocational & Adult School. Is member of A.S.M., Adult Education Association and Wisconsin Association of Directors of Vocational and Adult Education.

Curtis C. Drake, plant superintendent, Griffin Wheel Co., Denver, Colo. Has been with Griffin for 38 years. Is charter member and past chairman of AFS Timberline Chapter, charter member and past chairman, A.S.M. Rocky Mountain Chapter; immediate past president, Colorado Engineering Council; director, Rocky Mountain Post, American Ordnance Association; member, A.I.M.E., and of Colorado Historical Society. Has presented papers at Colorado School of Mines Engineers' Day Exercises, Colorado Engineering Council and various educational programs for AFS and A.S.M.

Robert W. Trimble, foundry superintendent, Bethlehem Supply Co., Tulsa, Okla. Born in Nebraska City, Neb., attended Kansas University, School of Education. Joined King White Way Co., St. Joseph, Mo., was transferred to Kansas City Hay Press Co., Kansas City, Mo. Employed by International Supply Co., Tulsa, as foundry superintendent. Company was purchased by Bethlehem Steel Co., and he continued in same position with new owner. Supervised foundry in Corsicana, Texas, plant as well as foundry at Tulsa.

Harold C. Erskine, assistant general manager, Aluminum Company of America, Casting Div. Appointed by AFS Board of Directors. A native of Trenton, N. J., he studied chemistry at Penn State College graduating with a B.S. degree. Joined Alcoa as apprentice at New Kensington, Pa., following Army service in World War I; transferred to company's central production planning division at Pittsburgh; later served as sales representative at New Haven and Hartford, Conn. Was named manager when Hartford sales office was established, later becoming manager of Alcoa's Fairfield works and then works manager at the company's Cleveland operations. Was named assistant general manager of the castings division. Served as an industrial member of the War Labor Board during World War II, and since February 1955, has been on loan to the U. S. Department of Commerce as director of the Aluminum and Magnesium Div., Business and Defense Services Administration.

Director, One Year

Frank J. Dost, president, Sterling Foundry Co., Wellington, Ohio, will serve for one year as Director following his term as President of AFS, as provided in the by-laws.

of industry; rapidly growing complexity; increasing age of top executives; and over-specialized training of executives. Much executive ability is misdirected with too many executives devoting too much time to operating details they should be delegating. Executives would aid growth of companies if they devoted more time and attention to functions of progress, limited time they devote to operating details. More time should be devoted to capital resources planning.

Modern Management Control. Roger K. Dailey, Lester B. Knight & Associates, Chicago. Modern cost procedures should establish what to do regarding direct materials and direct labor cost, comparisons of actual performance with established specifications, and reporting to management of differences between standard and actual performance. Foundry, sales, and other overhead expenses must also be controlled. Costs are predetermined by jobs in sufficient detail to produce accurate costs in advance.

In most foundries, the profit and loss statement does

Banquet Speaker Hugh M. Comer (center) gives General Manager Wm. W. Maloney (left) and President Frank J. Dost a preview of his address.

not reveal sources of loss or answer other vital questions. Flexible budgetary control, in combination with standard cost control, is essential if profit or loss is to be traced. This facilitates correct pricing, shows effect of volume, gives control of sales mixture of jobs in terms of profitability to reach a profit goal, shows break-even point of the business.

Brass and Bronze

The Functions of the Copper Div. B.D.S.A., W. A. Meissner, Copper Div., Business & Defense Services Administration, Dept. of Commerce, Washington, D. C. The copper div. determines the kind and amount of copper materials required to wage a successful war, and sees that facilities exist to produce these materials. To be strong for an emergency is to be strong domestically. The div. is providing, for the first time, industry-wide copper statistics and is helping secure stockpiled copper for periods of short supply.

Round Table Discussion. The application of a silica flour-western bentonite permanent mold wash was described. Because 300 F metal mold temperatures does not necessarily drive moisture from lumps of mix constituents it is imparative that the wash be well mixed, strained, and applied in 3 or 4 layers with a special type of spray gun to build a 0.025 to 0.230 in. thick coating. (0.005-in. coat is inadequate). pH was found to have no effect on mold washing.

Improvement of Pressure Tightness and Tensile Properties of Gun Metal Bronze by Vacuum Degassing. W. H. Johnson, H. F. Bishop, and W. S. Pellini, Naval Research Laboratory, Washington, D. C. Gun metal bronze melts were effectively degassed in a vacuum chamber. Tensile strength and ductility and pressure tightness were improved with degassing treatment. The inherent feeding deficiency of G Bronze is a problem apart from the gas problem and requires chilling to obtain ultimate soundness in sections beyond the riser feeding range.

Microporosity in Gunmetal Pressure Castings, Alfred Hesse, Stemac, Inc., Chicago. Microporosity in a pump cover is concentrated in the flange and, to date, areas of porosity have been moved by regulating the number and size of gates. It is apparent that high pouring temperatures and super-heat tend to reduce and even eliminate porosity leakage.

Short-Time Elevated Temperature Properties of Three Copper-Base Casting Alloys, J. O. Edwards, Dept. of Mines & Technical Surveys, Ottawa, Que. Strength at elevated temperatures is improved by additions of nickel to copper-base alloys. Alloys containing nickel may be suitable for valve seats, disks, glands, bushings, and similar valve or pump trim applications.

In such parts operating in 550 F steam, boiler water, or similar environments, ductility is a minor factor after the assembly has settled down to work, and improved performance should be realized from the increased strength and hardness of the alloys containing nickel.

Feeding of Castings, Thornton C. Bunch and George E. Dalbey, Mare Island Naval Shipyard Foundry, Vallejo, Calif. The production of radiographically sound plate castings is difficult even though the riser contains sufficient liquid metal at the time of casting solidification. Defects increase and mechanical properties generally decrease as the riser is approached.

Vapor Holes in Brass and Bronze Castings from Loose Sand Grains, W. B. George and Floyd Keller, R. Lavin & Sons, Inc., Chicago. Even though metal is poured at a high temperature, vapor holes often show up in certain castings because the metal is chilled while filling the mold cavity to the point where it cannot free itself of loose sand grains. However, metal can be poured at 1900 F, and even 1800 F, into the same molds without developing vapor holes if the mold is perfectly made with no trace of loose sand. (Pages 40-42, April).

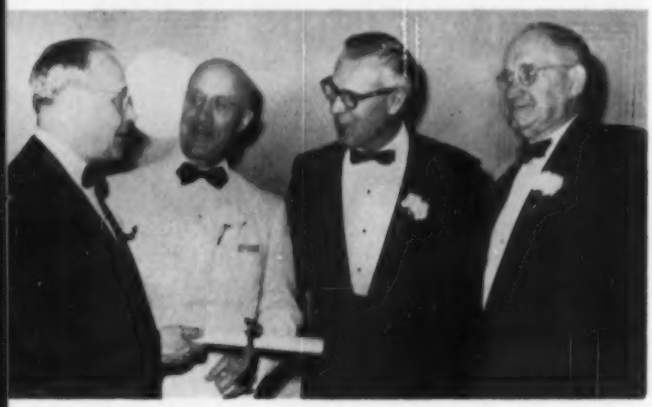
Investigation of Precision Casting of Experimental Propellers, A. R. Willner, Seymour Goodman, and Charles L. Tippett, David Taylor Model Basin, Washington, D. C. It was possible to reduce the man-days required of sand casting and machining experimental propellers an estimated 50 per cent by investment molding and vacuum pouring. A special wax mixture was developed to meet needs of the work. Salt was added to the plaster investment to allow cold water to be used without increasing set-up time. Cold water avoids fissuring of large masses of plaster on setting.

Brass & Bronze Shop Course

Molding Equipment for the Brass Foundry, C. V. Nass, Beardley & Piper Div., Pettibone Mulliken Corp., Chicago. The justification for mechanizing a foundry, large or small is improved quality at lower cost. In 1929 an unskilled foundry laborer received 38¢ per hour; in 1954 he earned $1.75 per hour. Skilled labor, such as a molder working piece rate, earned 75¢ per hour in 1929 and $2.50 in 1954. In 25 years direct common labor increased 4.6 times, skilled labor 3½ times; while Moody commodity index over the same period increased only 1.86 times. In addition to the increased cost of labor is the fact that industry is not training skilled men to replace their labor force; machines must be employed to make up this shortage. On the basis of 2000 hours work per year common labor costs $3500 and skilled, $5000; when fringe benefits are included these values are increased to about $4000 and $5500. If the productivity of only one skilled laborer can be increased just 15 per cent a small molding machine or bench coreblower costing about $750 can be justified. The small shop needs accurate knowledge of costs and skill in machine selection so as to maintain production flexibility and to make limited capital go the farthest.

Melting Equipment for the Brass Foundry, Harold J. Roast, Ottawa, Ont. Where capital outlay is no concern, the most efficient melting unit is the high-frequency induction furnace. Oil and gas have one economic advantage over electricity—no fixed charge. Flushing with dry nitrogen through a porous brick in the bottom of the ladle removes gases. For large quantities of brass, melt in an oil-fired reverberatory furnace or cupola. If speed of melting is paramount, use a stack-charged reverberatory. The indirect arc furnace is fast and convenient for alloys requiring high temperatures.

Dimensional Tolerances and Surface Structure in Various Shell Cast Metals, Richard A. Flinn, Walter B. Pierce, and Floyd R. Smith, University of Michigan, and Paul F. Youngdahl, Mechanical Handling Systems, Inc., Detroit. Cobalt base alloy, steel, nodular iron, gray iron, and 85-5-5-5 brass were poured into step-bar molds of resin bonded and synthetic sands. Better surface qualities were obtained in the lighter sections of the 1/16 to 2-in. test casting and with the cobalt base alloy and cast iron. Reaction of steel with the mold produced roughness in heavy sections and brass surfaces were rough from penetration. Varying resin content between 4 and 12 per cent had little effect.



Awards Chairman Fred J. Walls (left) with recipients of Honorary Life Membership (left to right) Frank C. Riecks, Frank J. Dost, and A. F. Pfeiffer.

Air Pollution Control

Comparing Change in Emission Rate with Change in Metal Melting Rate (Hot & Cold Blast Operation), R. C. Ortgies, American Air Filter Co., Inc., Louisville, Ky. Iso-kenetic sampling showed that cupola emission rate changed with the melting rate. Higher stack discharge, provides greater dissemination and there is less pollution in the area. The scientific method of determining the effluent from a cupola was discussed.

Developments of Air Pollution Problems and Their Effects on the Foundry Industry, George D. Clayton, George D. Clayton & Associates, Detroit. The Federal Government is considering the advisability of enacting legislation for the purposes of controlling air pollution. The stringencies of legislation now in effect were pointed out. Air pollution is a legal problem rather than a health problem, as air pollution is, in most cases, a nuscience instead of a health hazard. Foundry-

Shamrock Hotel was scene of 59th Annual AFS Convention Banquet.

men were urged to work with Federal authorities in guiding legislation now contemplated so that it will be reasonable.

Plaster Mold Casting

Make Plaster Cores in Rubber-Lined Boxes, Robert F. Dalton, Howard Foundry, Chicago. Plaster cores for external and internal surfaces of aluminum alloy castings can be made without draft, even with back draft, if the core box is lined with flexible rubber-like material. Such boxes not only eliminate loose pieces but are also economical, accurate, and easily duplicated. (AMERICAN FOUNDRYMAN, April 1955, pp. 46-49.) Mr. Dalton described each step in the manufacture of rubber lined equipment from conventional pattern and core box equipment.

Influence of Vibration on Fluidity and Filling During Investment Casting of an Aluminum Alloy, D. W. Levinson, A. H. Murphy, and W. Rostoker, Armour Research Foundation, Chicago. Vibration of low intensity improves markedly ability of metal to enter and to flow through relatively small channels due to the break-up of surface films that would otherwise impede or stop flow. Since superficial oxidation of the surface of virtually all metals and alloys can result in an apparently high surface tension, vibration will most likely improve apparent fluidity in any instance where rate of freezing is not the controlling factor.

Rubber-lined core box is discussed at the Plaster Mold session by, left to right, D. W. Levinson, Armour Research Foundation, Chicago; R. F. Dalton, Howard Foundry, Chicago; H. Rosenthal, Frankford Arsenal, Philadelphia; and R. G. Megaw, United States Gypsum Co., Chicago.

Light Metals

Foundry Characteristics and Properties of Magnesium Sand Casting Alloy HZ32XA, Kenneth E. Nelson, Dow Chemical Co., Midland, Mich. Commercial magnesium sand casting alloys can be listed in decreasing order of castability as 1. Mg-Al-Zn alloys except AZ63A in applications requiring maximum freedom from microporosity; 2. Mg-RE-Zr alloys; 3. Mg-Th-Zr alloys; and 4. Mg-Zn-Zr alloys. Addition of zinc to alloys 2 and 3 greatly reduces their tendency toward microshrinkage.

Mechanical Properties of Cast Titanium-Silicon Alloys, H. W. Antes and R. E. Edelman, Frankford Arsenal, Pittman-Dunn Laboratories, Philadelphia. Ultimate tensile strengths increased to a maximum of 108,500 psi with 1.8 per cent silicon, then decreased with further additions. Elongation decreased with increasing additions of silicon; alloys became quite brittle with additions of silicon greater than 1.8 per cent. Maximum energy absorbed at room temperature, was 46 ft-lb for a 0.07 per cent silicon alloy. Tensile properties of alloys tested were not as good as those of other cast alloys of titanium.

Application of Insulated Risers to Production of Aluminum Alloy Sand Castings, W. A. Mader, Oberdorfer Foundries, Inc., Syracuse, N. Y. Permeable gypsum plaster, expanded perlite, and exothermic mixtures, when used as riser sleeves and toppings and as pads, promote controlled directional solidification, improving casting quality and increasing casting yield. Intelligent chilling, in combination with insulating or exothermic materials, further aid in controlling directional solidification.

Conferring on Foundry Cost meeting plans are (seated) C. E. Westover, Westover Engineers, Milwaukee; and (left to right,) William Busby, Texas Foundries, Lufkin; Roger K. Dailey, Lester B. Knight & Associates, Chicago; and L. L. Ellis, Booz, Allen, & Hamilton, Chicago.

Meaning of the Cast Test Bar in the Evaluation of Aluminum and Magnesium Alloy Castings, A. G. Slachta and H. Mansfield, Wright Aeronautical Div., Curtiss-Wright Corp., Wood-Ridge, N. J. A test bar poured from a melt representing any given group of castings will have physical properties higher than test bars machined from the casting. This could be overcome only by gating, risering, and cooling the casting to the same degree that existed for test specimens. A test bar will reflect the ability of the parent melt to respond to heat treatment. This does not mean that the castings have been properly heat treated, but rather that

Inoculation was subject of Harold E. Barnum (center,) Vanadium Corp. of America, Detroit; at Gray Iron Shop Course session. At his left is E. J. Burke, Hanna Furnace Corp., Buffalo, N. Y.; Lyle L. Clark, Armour Research Foundation, Chicago, is at right.

Design for airframe casting is studied by, left to right, Manley E. Brooks, Dow Chemical Co., Bay City, Mich.; A. H. Peterson, Lockheed Aircraft Corp., Burbank, Calif.; and E. V. Blackman, Aluminum Co. of America, Pittsburgh, Pa.

the materials from which they are made is capable of being heat treated.

Mechanical Properties of Aluminum Alloy Castings, Roy E. Paine, Aluminum Co. of American, Vernon, Calif., and W. D. Stewart, Aluminum Co. of America, Pittsburgh, Pa.

Castings in Airframe Design, G. W. Papen, Lockheed Aircraft Corp., Burbank, Calif. Desirability of castings in airframes is obvious for parts on which aerodynamics demands complex curvature and rigorous weight considerations demand exact placing of material to meet varying loads, leading to steps, tapers, irregular shaped holes and recesses. Maximum use of castings amounts to only 4 per cent of airframe weight. Increased use of castings can be accomplished only by improvement in casting materials and techniques.

Measurement of Gas in Molten Aluminum, H. Rosenthal and S. Lipson, Pitman-Dunn Laboratories, Frankford Arsenal, Philadelphia. Under standardized conditions of testing, a correlation can be established between the density of atmospherically-solidified samples of aluminum alloy and the density of companion specimens taken from the same heat at the same time and solidified at reduced pressure. The volume of gas lost during reduced-pressure solidification is related to the initial gas content of the melt. Reduced-pressure solidification is essential to a rapid quantitative test for gas in aluminum (pages 69-73, June issue).

CO_2 process for hardening cores is explained by Dr. Waldemar Schumacher, Germany, second from left to E. C. Zirzow, Werner G. Smith Co., Cleveland; Roy Carver, Carver Pump Co., Muscatine, Iowa; and Hans J. Heine, AFS technical director.

Shell Molding of Magnesium Alloys, Nicholas Sheptak, Dow Chemical Co., Midland, Mich. Nine commercial and experimental magnesium alloys had lower physicals when cast in shell molds than in green sand molds. AZ92A alloy cooled as much as six times faster in green sand molds when poured at the same temperature. Reduced pouring temperatures and thicker molds and backing increased the cooling rate of metal cast in shell molds and raised tensile properties to that of green sand cast bars. Insulating properties of shell molds make them valuable in casting thinner walled castings and for greater yield.

A Case Study of a Premium Strength Casting, A. J. Carah, Douglas Aircraft Co., Inc., Santa Monica, Calif. With more than normal time and effort in casting development, with consistent control of foundry processes to closer limits, and with a purchaser willing to pay a premium price, it was possible to replace a machined-extrusion missile fitting with a casting having yield strengths over 26000 psi, ultimates over 45000, and elongation approximately 13.5 per cent. This change has already saved $500,000 and promises to reach $1,500,000.

Production of Aluminum Alloy Specification Castings, R. E. Paine and P. V. Faragher, Aluminum Co. of America, Vernon, Calif., and Pittsburgh, Pa., respectively. Before a casting is put into production, several sample castings are made to establish the foundry technique to be used (establishment of foundry controls to meet specification). Direct-reading spectrographs and rapid sample delivery systems make it possible to have analysis before pouring and to use scrap in furnace charges.

Mechanical Properties of Aluminum Alloy Castings, R. E. Paine, Aluminum Co. of America, Vernon, Calif. The concept of considering test specimens machined from aluminum alloy castings to have 75 per cent of the tensile and 25 per cent of the elongation required for separately cast test bars, is not representative of

At the President's Reception . . Past President and Mrs. L. N. Shannon are greeted by General Manager Wm. W. Maloney. Others in receiving line are Mrs. Maloney, President Frank J. Dost, Mrs. Dost, Vice-President Bruce L. Simpson, Mrs. Simpson, Incoming Vice-President Frank W. Shipley, and Mrs. Shipley.

mechanical properties available in many designs of aluminum alloy castings. Breakdown tests provide more reliable information than do tests of machined specimens. Of production variables, rate and direction of solidification have the greatest effect on mechanical properties.

A Study of Fluid Flow of Light Alloys Through Vertical Gating Systems—Research Project Co-sponsored by Frankford Arsenal and American Foundrymen's Society. J. G. Kura, Battelle Memorial Institute, presented the latest color, sound motion picture on new research into vertical gating.

Malleable

Effects of Trace Amounts of Tin, Lead, and Antimony on Annealing of Blackheart Malleable Iron, R. C. Shany, J. E. Wilson, Dept. of Mines & Technical Surveys, Ottawa, Ont., and J. E. Rehder, Canada Iron Foundries, Montreal, Que. Within the concentrations of the investigation, neither tin, lead, nor antimony appear to have an appreciable effect on first stage annealing. However traces of tin and antimony promote graphitization in second stage annealing, but through different mechanisms.

Embrittlement, Toughening, and Subcritical Thermal Treatment of Malleable Iron, G. E. Kempka, University of Wisconsin. Rapid cooling of malleable iron from around 1200 F results in high strengths and resistance to embrittlement. Embrittlement after heating to 800-900 F and water quenching occurs to the greatest degree in high phosphorus irons which previously had been slowly cooled from around 1200 F. Irons may be embrittled or strengthened by subcritical thermal treatments.

Producing Solid Castings with Minimum Cost for Feeders, B. C. Yearley, National Malleable & Steel Castings Co., Cleveland. Basis of feeding problems lies in how you take heat out of the metal poured into the mold. Principles of risering and feeding distances worked out to a considerable extent in steel are also applicable to white iron. Dispersed shrinkage beyond the feeding range of the riser cannot be cured by increasing riser diameter or height. A feeder must be larger than the section it is intended to feed because the riser is solidifying while the casting is freezing and approaching the point of maximum feed metal demand.

Effects of Molybdenum on Stability and High Temperature Properties of Pearlitic Malleable Iron, W. Scholz and D. V. Doane, Climax Molybdenum Co., Detroit. In the temperature range 1000-1200 F, molybdenum was found to retard rate of softening and secondary graphitization and to raise short-time tensile and yield strengths after exposures up to 1000 hours. Stress-rupture tests on specimens, stabilized by holding at 1200 F for 1000 hours, showed that the stress to produce rupture in any specified time at 1100 F was increased almost 50 per cent by alloying with approximately 0.2 per cent molybdenum. A pre-tempered pearlitic matrix developed higher short-time tensile strengths in the 1000-1200 F range after prolonged exposures than an original matrix of bainite.

Among Convention Committee members at the reception were left to right below:

. . . Jake Dee, Mrs. Dee, Mrs. F. M. Wittlinger, and F. M. Wittlinger . . .

Interrelation of Heat Treatment, Mechanical Properties, and Machinability of Pearlitic Malleable Iron, J. E. Kruse, Albion Malleable Iron Co., Albion, Mich. Mechanical properties of pearlitic malleable iron depend upon quantity, size, shape, and distribution of the structural constituents. A relationship between hardness and microstructure permits the prediction of mechanical properties. (July issue).

Effects of Some Melting Variables on Properties of Malleable Iron, G. E. Kempka and R. W. Heine, University of Wisconsin. Water vapor in air furnace atmosphere causes a serious lowering of elongation and tensile strength, but only mildly effects the yield point. Water vapor has little effect on first stage graphitiza-

tion time, yet adversely affects the second stage. It appears that ductility and tensile are decreased while yield is little affected by increases of sulphur from 0.04 to 0.21 per cent. First stage graphitization time did not seem to be altered by sulphur content; however, low sulphur was accompanied by a retarded second stage.

Metallurgical Controls for Duplexed Malleable, L. E. Emery, Marion Malleable Iron Works Div., Chicago Railway Equipment Co., Marion, Ind. Purchase all raw materials on specification for better basic, initial control. Keep graphitic-carbon bearing materials under control to improve nodules and physicals. Use sound cupola practice to lessen loss of silicon and manganese for better annealability. Select proper metallurgical coal for furnace atmosphere control. Make proximate analysis of each car of coal. (June, pages 90-95).

. . . C. W. Williamson, Mrs. Williamson, Edward W. Wey, and Mrs. Wey . . .

Malleable Shop Course

Effects of the Melting Process on the Cracking Tendencies of Malleable Iron, F. W. Jacobs, Texas Foundries, Lufkin, Texas. For a given gating and pouring system the metal iron oxide content must be held within a definite range. Too low a content promotes fluidity, shrinks, large dendritic grains, and cracks. At the other extreme, iron becomes fast setting and develops intergranular weakness; resulting shrinks and hot cracks are accompanied by misruns and blows.

Industrial Engineering

Production Standards and Their Place in the Foundry Industry, Stuart D. Martin, Central Foundry Div., General Motors Corp., Saginaw, Mich. Standards in three G.M.C. Central Div. foundries cover accurate parts costs, cost estimating, and efficiency and manpower utilization for over 1000 parts. Management receives more accurate data on plant performance and costs, facilitating cost estimating, daily employee performance, and results in more accurate selling prices. Employee relations are improved, as also are quality and quality control. At present, 88.2 per cent of total hours, productive and nonproductive, are on standards.

Improving Foundry Paperwork, M. E. Mundel, Marquette University, Milwaukee. Written communication processes were examined with respect to the design or layout of the physical (format) phase, the way (method) in which each individual job is performed, the path taken by a communication (procedure) and the distribution of work. A person should be assigned responsibility for simplifying paper work and management should support this activity enthusiastically.

Sand Shop Course

Fitting Sand Control to Your Foundry. Gray Iron Production Shop—T. C. Alford, Wheland Co., Chattanooga, Tenn. Use a sand mixture that is as simple as possible for the type of casting to be produced. Select sand for grain distribution and fineness, use western bentonite for high hot strength and deformation, southern bentonite for flowability and low hot strength, sea coal for peel and finish. Moisture is the most important property because it influences all the others. Next in importance is green deformation. In charge of molding material should be someone with authority over molding, core, and sand departments. Benefits of sand control—better castings at lower cost—are: lower scrap, better finish, easier shakeout, better cleaning, and higher production.

. . . W. B. Wallis, James R. Hewitt, Mrs. J. O. Klein, J. O. Klein, and Mrs. Hewitt . . .

Malleable Shop—F. W. Jacobs, Texas Foundries, Inc., Lufkin, Texas. Sand control foreman, in charge of sand control, reports to foundry superintendent; metallurgical department operates sand laboratory and works on consulting basis. Changes in molding material specifications, methods of producing sand, and control limits of tests are made only with full agreement of molding, coremaking, sand, and metallurgical departments.

Chemically Treated Sand System—Harry Wilson III, Electron Corp., Littleton, Colo. Sand used in this shop, essentially set up to produce V-belt sheave castings, contains a dry powder for dry and hot strength, and a liquid chemical for flowability and peel. Moisture, flowability, green strength, and deformation are checked hourly, clay content and grain distribution daily. Properties, in order of importance, are: moisture, flowability, green strength, and deformation. Benefits of sand control include: better finish, lower casting cleaning time and better conformation to pattern size.

Head table at Brass and Bronze Round Table luncheon included, left to right, George H. Bradshaw, Philadelphia Naval Shipyard; F. L. Riddell, H. Kramer & Co.; H. C. Ahl, Jr., Down River Casting Co.; W. A. Meissner, Copper Div., Business & Defense Services Administration, Dept. of Commerce; B. A. Miller, Crown Non-ferrous Foundry, Inc.; B. N. Ames, Doran Manganese Bronze Corp.; and Wm. Romanoff, H. Kramer & Co.

Sand Preparation Without Guesswork, William E. Patterson, Elkhart Foundry & Machine Co., Elkhart, Ind.; and Jean Danenfelser, International Harvester Co., Indianapolis. Automatic tempering units in a 200 tons natural sand per day jobbing shop and in a synthetic sand high production shop stabilized permeability, improved flowability, and reduced labor and supervision. Hot sand is tempered on the heavy side to compensate for losses in handling and molding.

The Carbon Dioxide Process for Hardening Cores and Molds, Dr. Waldemar Schumacher, Concordiahutte, A. G., Berndorf am Rhein, Germany. Sand bonded with a special water glass and cured in an atmosphere of CO_2 is used to make cores and molds for ferrous and nonferrous castings of almost any size as long as there is no backdraft and no large flat vertical areas. Flasks are packed by ramming or jolting; reinforcing is minimized or eliminated. Holes are punched into the green sand to permit CO_2 gas introduced at about 30 psi pressure to permeate the sand, completely hardening it. Thereupon, the pattern is removed and the mold washed, used, or stored indefinitely. Long drying and baking times are not necessary, ovens are eliminated, handling and transporting are greatly reduced, productivity is increased, and expensive core binders are avoided. (July issue).

Gray Iron Shop Course

Practical Inoculation of Cupola Melted Irons, Harold E. Barnum, Vanadium Corp. of America, Detroit. Although graphitization-type inoculants are used primarily on irons with low carbon equivalent and stabilizing types with higher equivalent irons, both together (double inoculation) produce unusually high physicals in low equivalent irons. Six tips for good inoculation: know ladle capacities (they change); size inoculant material; weigh it accurately; if possible, add it mechanically; allow time for addition to take effect; pour as hot as the casting and sand will take it; and check practice frequently to detect changes that have crept into practice.

Efficient Cupola Operation, E. E. Pollard, Tyler Pipe & Foundry Co., Tyler, Texas. Efficient cupola operation calls for effective means of unloading and storing raw materials, and accurate methods of making up charges. Mechanical charge weighing and handling equipment not only reduces charging costs but also provides composition control through accurate weighing. Control methods available include temperature measurement by optical pyrometer and continuous recorder, slag control, desulphurization, and air-weight control. Modified water-cooled cupolas are especially useful for extended heats.

Plant and Plant Equipment

Shell Molding Process and Equipment, Carl O. Schopp, Link-Belt Co., Indianapolis, and James Sutherland, Link-Belt Co., Chicago. Developments from the simple dump box to the completely automatic multiple-station machine were discussed and illustrated. Shell molded castings have superior finish and closer dimensional accuracy (0.003-in. per in.). Shell molded castings are more competitive with machining, forging, and welding operations. Shell molding allows better working conditions and the use of relatively unskilled labor in the process.

Malleable Round Table Luncheon attendants included (left to right) Collins L. Carter, Albion Malleable Iron Co.; C. C. Chambers, Texas Foundries, Inc.; C. F. Joseph, Central Foundry Div., General Motors Corp.; J. H. Lansing, Malleable Founders' Society; R. Schneidewind, University of Michigan; B. C. Yearley, National Malleable & Steel Castings Co.; Eric Welander, John Deere Malleable Works; M. Tilley, National Malleable & Steel Castings Co.; J. E. Rehder, Canada Iron Foundries, Ltd.; and F. B. Rote.

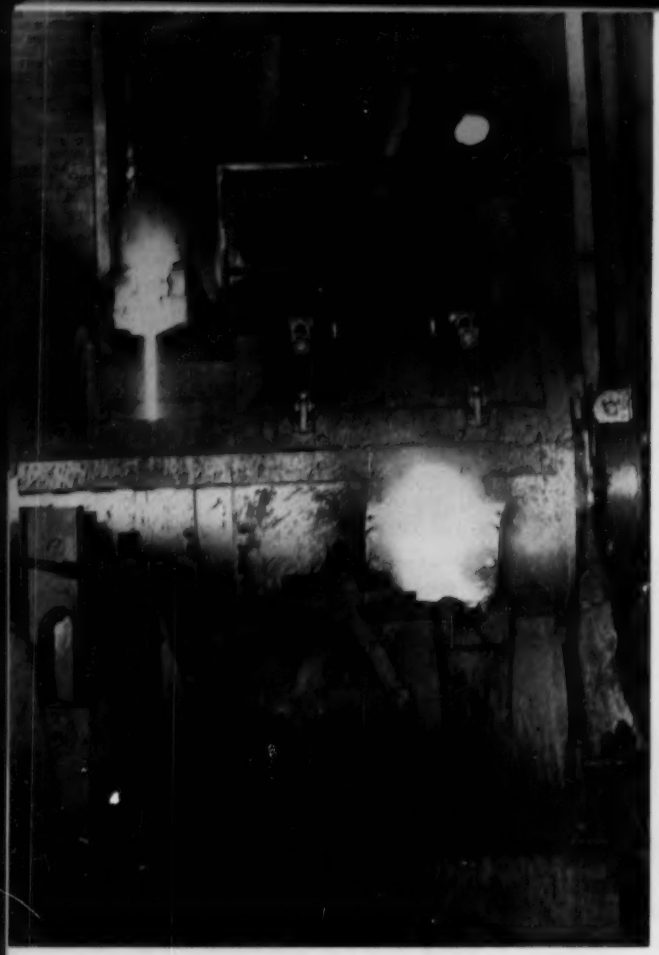
TEXAS Chapter BARBECUE

Above . . Breaking fictitious laws resulted in numerous "arrests." Shaking the door of the jail is AFS Past President Collins L. Carter, Albion Malleable Iron Co., Albion, Mich.

Left . . Walter L. Seelbach, Superior Foundry Co., Cleveland, an AFS past president, was surprised to learn that news of his birthday had preceded him to the Lone Star State when he was given a cowboy shirt by the Texas Chapter.

Left . . Davy Crockett fan gets assistance in handling horse from member of sheriff's posse. Young foundryman is Bill White, son of Mr. and Mrs. Wm. J. White, Shallway Corp., Connellsville, Pa.

Right . . Group of University of Alabama Student Chapter members made convention expenses by selling castings (name plates, fruit bowls, andirons) which they produced from pattern to finished product. Pictured (left to right) are: Dick Hopper, Bobby Phillips, Prof. Warren C. Jeffery, Harry Bradshaw, and Ralph Reid. Kept home by an exam schedule were Charles Eason, R. L. Hutton, Gene Gorham, and Norman Bevis.



in the ladle...

Five Ways to Desulphurize

D. E. PARSONS / *Met. Eng., Phys. Met. Div.*
Dept. of Mines and Technical Surveys, Ottawa, Ont.

S. L. GERTSMAN / *Div. Chief Asst., Phys. Met. Div.*

■ Desulphurization of iron makes possible the use of a larger proportion of gray iron scrap in the cupola charge, results in a saving of ferromanganese, and, where the initial sulphur content is high, improves the fluidity of the iron for casting.[1] Probably the most important reasons for sulphur reduction are to produce iron with less than 0.025 per cent sulphur for inoculation in the production of nodular iron,[2,3] and to meet increasingly stringent sulphur specifications.

Some reduction of sulphur content of the iron can occur during melting in the acid cupola, but development of a sufficiently basic slag in the acid cupola results in excessive slag volumes and in corrosion of the acid refractories. Desulphurization in the basic cupola is effective but, in some circumstances, basic practice has been more expensive than use of the acid cupola furnace followed by ladle treatment of the iron.[4,5] Hence, there is incentive to improve the ladle treatment of iron from both the cost and production viewpoints.

Reduction of the sulphur content of gray iron by means of a ladle treatment has been investigated. The treatment consisted of making controlled additions of caustic soda, soda ash, calcium carbide, calcium cyanide, or lime to the tap stream or ladle and comparing the amount of sulphur removed by each addition. The effect of the ladle treatments on the mechanical properties, nitrogen contents,[6] and metallographic structures of a series of gray iron melts was also examined.

A double ladle treatment was used and all the other test conditions were intended to simulate the normal practice in the production of gray iron castings.

Results of the study show:

1. Under the test conditions imposed, there was a linear

increase in per cent sulphur reduction with increasing addition, 15 to 40 lb/ton, of caustic soda, soda ash, calcium carbide, lime or calcium cyanamide to the tap stream.

2. Desulphurization with calcium cyanamide is more effective when the iron is tapped directly onto the cyanamide than when the addition is made to the stream.

3. The nitrogen level of electric furnace iron, treated with caustic soda, soda ash, calcium carbide, or lime tends to be maintained at the original level, or is lowered during the ladle treatment. The nitrogen content of heats desulphurized with ladle additions of calcium cyanamide tends to increase to 0.020-0.023 per cent regardless of the initial nitrogen content of the heat. The final nitrogen content of heats treated with caustic soda, soda ash, calcium carbide, or lime was of the order of 0.008 per cent.

4. Ladle treatment with the larger addition of caustic soda or soda ash resulted in loss of silicon from the bath.

5. The mechanical properties of heats treated with 40 lb/ton of caustic soda, soda ash, or calcium carbide were not significantly changed by the ladle treatment. The tensile strength of heats treated with 40 lb/ton of lime or with additions of 20 or 30 lb/ton of calcium cyanamide was increased.

A direct-arc electric furnace was used for melting. Heats of 450 lb were prepared from construction scrap and electrode graphite to give a target analysis of: C, 3.50 per cent; Mn, 0.50; Si, 2.00; S, 0.10; and P, 0.02. Graphite was charged before meltdown, and additions of elemental sulphur, ferrosilicon, and 1 lb of ferromanganese were made to the bath 15 minutes before tapping. The melt time and tap adjustments were kept constant within narrow limits, and power consumption varied between 180 kwh and 200 kwh per 450-lb heat.

The bath was superheated to 1550 ±15 C before pouring. It was immediately slagged off and then allowed to cool to 1500 ± 15 C before tapping into an acid-lined lip pour ladle.

The required addition of desulphurizing compound

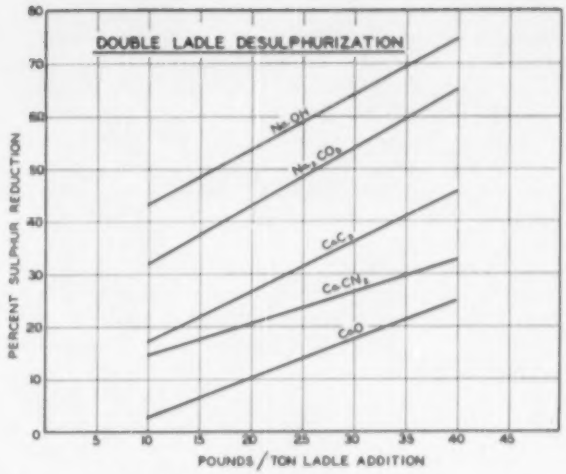


Fig. 1 . . Linear relationships in desulphurization.

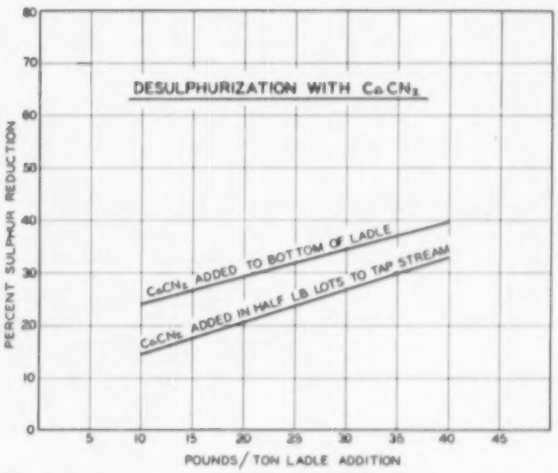

DESULPHURIZATION WITH CaCN2
PERCENT SULPHUR REDUCTION
POUNDS / TON LADLE ADDITION
CaCN2 ADDED TO BOTTOM OF LADLE
CaCN2 ADDED IN HALF LB LOTS TO TAP STREAM

Fig. 2 . . For more effect add $CaCN_2$ to ladle bottom.

Table 1 . . Sulphur Reduction Obtained with Additions of 15-40 lb/ton of Compound
(Initial Sulphur Content = 0.1%)

NaOH Addition, lb/ton	% Sulphur Reduction after 5 min	Na_2CO_3 Addition, lb/ton	% Sulphur Reduction after 5 min	CaC_2 Addition, lb/ton	% Sulphur Reduction after 5 min	CaO Addition, lb/ton	% Sulphur Reduction after 5 min	$CaCN_2$ Addition, lb/ton	% Sulphur Reduction after 5 min
15	40	15	42	10	17	15	4	10	17
15	47	15	33	15	15	15	8	10	18
20	57	15	43	15	29	20	17	15	22
20	56	15	17	20	25	20	10	15	22
20	56	15	37	20	33	20	10	20	13
25	64	20	41	25	33	25	11	20	13
25	54	20	48	25	26	25	10	25	22
25	66	20	40	40	44	40	25	25	21
30	61	20	46	40	41	40	18	40	35
40	81	20	54	40	54	40	13		35
40	73	25	61			40	30	40	35
40	74	25	37			40	47	40	35
40	73	25	55			40	19		
40	70	40	69						
		40	71						
		40	50						

was made to the stream in ½-lb lots, except for one series of tests in which it was put in the bottom of the ladle before pouring. After tapping, the iron and slag were hand-stirred for three minutes so that the slag would melt and spread over the metal surface. The iron was then poured into a teapot-type ladle, from a height of five feet. The metal and slag were allowed to remain undisturbed in this second ladle for two minutes, after which the iron was cast into keel blocks and pig molds.

Samples for chemical analysis were taken immediately before tapping and from the first ladle after holding three minutes. A third sample was taken at the same time the keel blocks were poured (five minutes after tapping). All the samples were cast in dry-sand bar molds 1 x 1 x 6 in. Chemical analyses were made on drillings from these test bars, and check analyses were occasionally made on the keel blocks and pig metal. Temperatures were measured by use of an immersion Pt-Pt 13 per cent Rh thermocouple connected to a recorder.

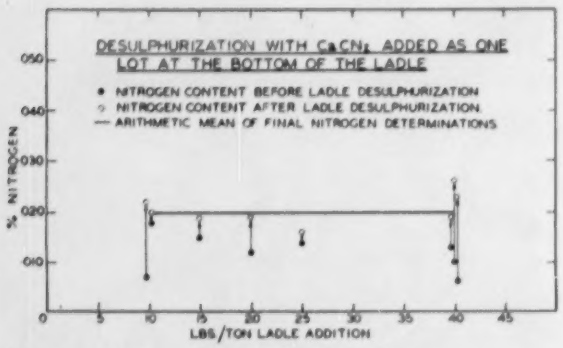

DESULPHURIZATION WITH CaCN₂ ADDED AS ONE LOT AT THE BOTTOM OF THE LADLE
NITROGEN CONTENT BEFORE LADLE DESULPHURIZATION
NITROGEN CONTENT AFTER LADLE DESULPHURIZATION
ARITHMETIC MEAN OF FINAL NITROGEN DETERMINATIONS
% NITROGEN
LBS/TON LADLE ADDITION

Fig. 3 . . N_2-$CaCN_2$ relationship for ladle additions.

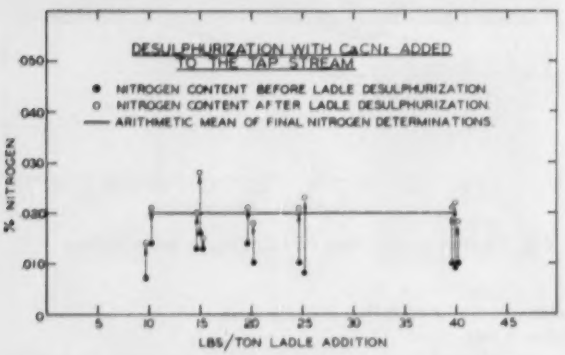

DESULPHURIZATION WITH CaCN₂ ADDED TO THE TAP STREAM
NITROGEN CONTENT BEFORE LADLE DESULPHURIZATION
NITROGEN CONTENT AFTER LADLE DESULPHURIZATION
ARITHMETIC MEAN OF FINAL NITROGEN DETERMINATIONS
% NITROGEN
LBS/TON LADLE ADDITION

Fig. 4 . . Nitrogen increase is same for stream additions.

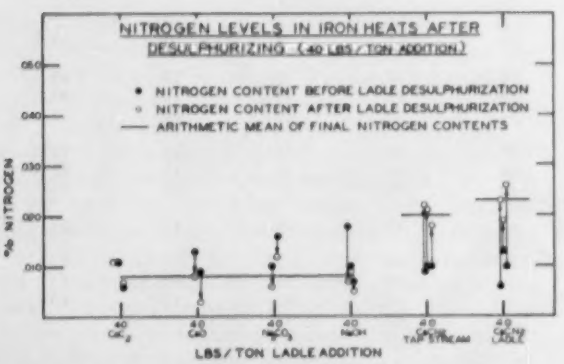

NITROGEN LEVELS IN IRON HEATS AFTER DESULPHURIZING (40 LBS/TON ADDITION)
NITROGEN CONTENT BEFORE LADLE DESULPHURIZATION
NITROGEN CONTENT AFTER LADLE DESULPHURIZATION
ARITHMETIC MEAN OF FINAL NITROGEN CONTENTS
% NITROGEN
LBS/TON LADLE ADDITION

Fig. 5 . . Effects of 40 lb/ton additions on nitrogen.

To test the effect of ladle treatment on mechanical properties, keel blocks cast before and after ladle treatment were required. Accordingly, for a series of melts, the bath was preheated and tapped at 1500 C as described. The first 60 lb of metal was poured into a hand ladle, allowed to cool to 1325 C, and then was cast into the standard keel block. Simultaneously, the remaining metal was tapped, given a ladle desulphurizing treatment, and then cast into keel blocks at 1325 C. It was found that by controlling the superheat and tapping temperatures at 1550 C and 1500 C respectively, a casting temperature of 1325 C (±5 C) resulted after the five-minute reaction period.

Four chemical analyses for sulphur content were made from each of these heats. These samples were obtained from the furnace immediately before tapping, from a test bar poured with the initial keel block, from a ladle sample taken after 3 minutes, and from a test bar poured with the final keel blocks.

Analysis for carbon, manganese, silicon, sulphur, and phosphorus was made on the furnace sample and on the final test bar from each heat. Nitrogen determinations were made, using a modified Kjeldahl wet method and the Nessler colorimetric procedure, on heats before and after desulphurization with calcium cyanamide. Nitrogen analyses were also obtained on a series of heats desulphurized with 40 lb/ton of each of the other compounds.

Eighty heats were made for the desulphurization program reported here. The per cent reduction of sulphur was obtained for additions of 15 to 40 pounds per ton of each of the compounds added to the tap stream, and the results are shown in Table 1. Equations for the best fitting straight lines were computed using standard regression methods. It was found that in every case the resulting linear relationships accounted for most of the total variation. Very little improvement, if any, would be obtained by postulating a more complex type of relationship. Figure 1 illustrates the linear increase in per cent sulphur reduction obtained by varying stream additions of caustic soda, soda ash, calcium carbide, calcium cyanamide, or lime.

Additions of caustic soda (flakes) or of soda ash to the stream resulted in vigorous reactions accompanied by a boil and a very thin slag. Numerous pin points of yellow sodium flame were observed at the slag surface, especially for the first three minutes of the reaction. There was an evolution of acrid white fume which was removed by a fan located above the ladle pit. This thin slag was difficult to control in the teapot ladle. After cooling, the slag was chocolate brown in color and could be separated from the solidified pig metal. The slag resulting from additions of caustic soda had a tendency to deliquesce and become wet and tarlike after a few hours' exposure to the air.

Calcium carbide reacted quietly with the iron, forming a dry "popcorn" slag which was easily controlled during pouring.

Lime, when added to the tap stream, remained as a

Fig. 6 . . Before desulphurizing. 200X, unetched.

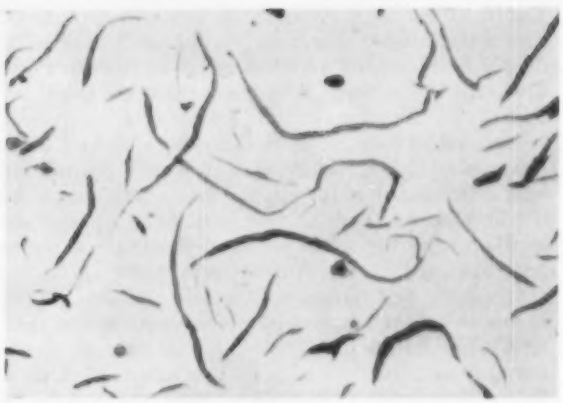


Fig. 7 . . After addition of 40 lb/ton CaO. 200X.

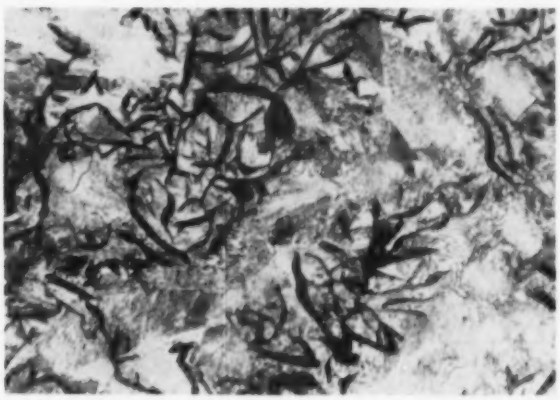


Fig. 8 . . Same as Fig. 6 except etched in 2% nital.

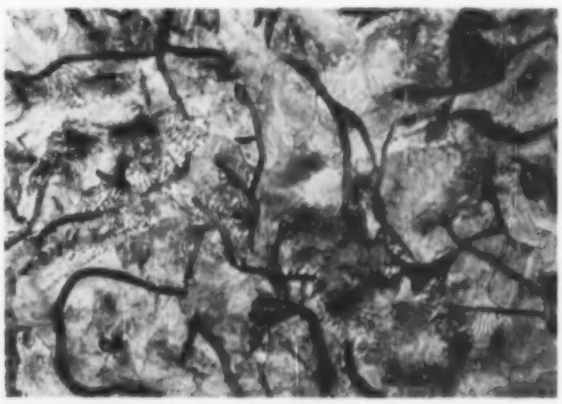


Fig. 9 . . Same as Fig. 7 except etched in 2% nital.

Table 2. . Sulphur Reduction Obtained with Additions of 10-40 lb/ton of $CaCN_2$

(Initial Sulphur Content = 0.1%)

$CaCN_2$ added in ½ lb lots to the tap stream		$CaCN_2$ added as one lot at the bottom of the ladle before tapping	
Addition, lb/ton	% S Reduction after 5 min	Addition, lb/ton	% S Reduction after 5 min
10	17	10	9
10	18	10	36
15	22	15	25
15	22	20	33
20	13	25	36
20	13	40	41
25	22	40	35
25	21		
40	35		
40	35		
40	35		

powder on the surface of the iron in the ladle. Some loss of the fine powder occurred when the ladle was stirred. The metal remained quiet and the powdery lime slag was easily held back during pouring.

Table 2 shows a comparison of sulphur reductions obtained when calcium cyanamide was added to the tap stream and when it was placed in one lot at the bottom of the ladle before tapping. Figure 2 illustrates that the per cent sulphur reduction varies linearly with increasing additions of calcium cyanamide added by the two methods, and also shows the change in desulphurizing efficiency which can be obtained by changing the method of addition.

Calcium cyanamide additions to the stream or ladle produced a boil, that, while not as vigorous initially as that obtained with caustic soda, generated a large volume of gas. It continued longer than the boil resulting from the addition of caustic soda ash. The slag formed a crust about six inches above the surface of the molten iron in the ladle. With smaller additions of calcium cyanamide, a "popcorn" slag formed on the iron surface. Gas evolution was still taking place five minutes after additions of 40 lb/ton of calcium cyanamide. This resulted in gassy castings. However, sound castings were poured after additions of 20 or 30 lb/ton of calcium cyanamide using both methods of addition. The slag resulting from calcium cyanamide additions was easily held back in the ladle during pouring.

Figures 3 and 4 show the results of nitrogen determinations made before and after desulphurizing with calcium cyanamide using both methods of addition. The graphs illustrate the tendency of the final nitrogen content to stabilize at 0.020-0.023 per cent regardless of the initial nitrogen content. Figure 5 shows nitrogen results obtained before and after desulphurizing with additions of 40 lb/ton of the five compounds tested.

The final nitrogen contents of heats desulphurized with compounds other than cyanamide remained at their initial levels or were lowered. The lines in Fig. 5 illustrate the difference in final nitrogen levels obtained after additions of 40 lb/ton of each compound.

Mechanical test results obtained on 1-in. keel block legs cast at 1325 C before, and after desulphurization with additions of 40 lb/ton, are shown in Table 3. All the keel blocks desulphurized with 40 lb/ton calcium cyanamide were gassy, hence no mechanical test results were obtained for iron treated with 40 lb/ton of this compound. Test bars desulphurized with 20 and 30 lb/ton of calcium cyanamide were obtained and these results are shown in Table 4. An increase in tensile strength was observed in heats desulphurized with 40 lb/ton lime or 20-30 lb/ton of calcium cyanamide. No increase in tensile strength was observed in heats desulphurized with 40 lb/ton of calcium carbide, caustic soda, or soda ash.

Table 5 shows the per cent silicon reduction which occurred in heats desulphurized with 15-40-lb additions of caustic soda or soda ash. Reductions up to 30 per cent of the initial silicon content of the iron were observed. No effect was observed with the other compounds tested.

Metallographic examination of test bars before and after desulphurization with 40 lb/ton of each compound showed that the graphite flakes, after treatment, were more randomly distributed, were usually larger, and had a tendency to be bent or curled. Figures 6 and 7 illustrate this appearance in a melt desulphurized with 40 lb/ton of lime. Figures 8 and 9 show the same specimens after etching. The micro-structures of all the samples consisted of graphite flakes and fine pearlite.

Table 3 . . Mechanical Properties of 1-in. Keel Block Sections Before and After Desulphurization with 40 lb/ton of Compound

Carbon Before Treatment	Equivalent After Treatment	Desulph. Compound added	*U.T.S. Before Desulphurization, psi.	*U.T.S. After Desulphurization, psi.	Heat No.
4.29	4.35	CaO	17000 16200 17500	19600 19800 19600	489
3.92	3.89	CaO	33600 33800 34900	38200 37400 37800	508
4.24	4.07	CaO	41200 40600 40600	44200 45800 44100	530
4.18	4.03	Na_2CO_3	33800 31700 32800	31900 31300 31800	507
4.18	4.05	Na_2CO_3	30700 31500 31200	36900 36300 36800	529
4.20	4.19	CaC_2	29000 27600 27800	26400 25500 25600	488
3.84	3.83	CaC_2	36750 40000 40000	35700 35500 34500	526
4.21	4.15	NaOH	25400 23300 23800	27800 27000 26900	487
3.75	3.65	NaOH	31400 33000 32700	31400 30700 31700	528

*Triplicate results obtained by breaking sets of three bars.

Caustic soda and soda ash were the most effective desulphurizers under the test conditions. The slopes of the lines (Fig. 1) obtained by plotting per cent sulphur reduction vs. lb/ton addition, were identical for the two sodium compounds. The slopes (Fig. 1 and 2) of all the other agents varied; that of calcium carbide was nearly as steep as the sodium compounds. Calcium carbide, however, was not as effective a desulphurizer as caustic soda or soda ash under test conditions. Desulphurization was more effective when calcium cyanamide was placed directly in the bottom of the ladle than when it was added to the tap.stream.

Caustic soda produced objectionable fumes, a very thin slag, and a ladle reaction vigorous enough to eject a small amount of slag from the ladle. Use of soda ash gave somewhat lower desulphurization results and again produced a very thin slag. The thin slags are satisfactory where slagging off is carried out continuously, but are less satisfactory in ordinary casting practice where the slag is held back by the ladle spout. The tendency of caustic slags to pick up moisture at room temperature is also objectionable.

Use of lime resulted in loss of fine powder when the bath was stirred, and did not give optimum desulphurization in the ladle. To prove this, one heat of iron was

Table 4 . . Mechanical Properties of 1-in. Keel Block Sections Before and After Desulphurization with Calcium Cyanamide

Carbon Before Treatment	Equivalent After Treatment	Addition, lb/ton $CaCN_2$	U.T.S. Before Desulphurization, psi.	U.T.S. After Desulphurization, psi.	Heat No.
4.22	4.22	20	17900 17000 17100	20600 20500 20200	*538
3.91	3.95	30	27700 26600 26900	31200 30000 30500	*539
3.92	3.90	20	34000 35600 34400	38300 37600 39000	°543
4.13	4.11	30	29300 28200 28100	35300 35800 36200	°542

* Additions of calcium cyanamide made to the tap stream
° Additions of calcium cyanamide made in one lot at the bottom of the ladle

Table 5 . . Silicon Reduction Occurring with NaOH or Na_2CO_3 for Ladle Desulphurization

NaOH lb/ton	% Si Reduction, 5-min Ladle Test	Heat No.	Na_2CO_3 lb/ton	% Si Reduction, 5-min Ladle Test	Heat No.
15	6.2	402	15	8.9	400
15	9.6	467	15	4.0	437
20	11.8	403	15	29.0	439
20	9.2	436	15	3.8	481
20	10.3	466	15	3.5	482
25	28.0	387	20	7.5	430
25	9.2	425	20	25.4	441
25	8.7	465	20	5.8	470
30	8.7	433	20	9.8	483
40	14.5	404	20	34.6	484
40	16.2	434	25	33.0	386
40	32.2	449	25	6.7	438
40	27.8	486	25	16.0	442
40	19.2	487	40	9.5	401
40	24.6	528	40	35.0	443
			40	11.1	507
			40	17.2	529

desulphurized by injecting 24 lb/ton of lime beneath the metal bath in a stream of argon. This increased the sulphur reduction from 15 per cent, obtained by ladle addition, to 47 per cent, indicating the benefit of thorough mixing and intimate contact.

Calcium carbide behaved well as a ladle addition. The reaction was quiet, the sulphur reduction predictable, and the "popcorn" slag easily retained in the ladle during pouring. No increase of the carbon content of the bath resulted when this compound was used for desulphurization.

Calcium cyanamide ladle treatments produced sound castings where the ladle addition did not exceed 30 lb/ton. This compound also behaved well in the ladle, producing a vigorous but controllable evolution of gas. The slag which formed after tapping insulated the bath by forming a crust about six inches above the metal. Stirring this crust into the metal helped complete the reaction and stop the evolution of gas so that sound castings could be poured.

Comparison of the per cent desulphurization obtained after 3 minutes and after 5 minutes of ladle reaction indicated that the reaction with caustic soda and soda ash was complete after 3 minutes of hand-stirring, whereas a slight increase in desulphurization was obtained by reladling the lime, calcium carbide, or calcium cyanamide mixture.

The results of the nitrogen determinations indicate that when calcium cyanamide is used, a final nitrogen level of 0.020-0.023 per cent can be expected under the test conditions. This nitrogen level was significantly higher than nitrogen contents of the order of 0.010 per cent, obtained after treatment with the other compounds. There was a tendency for the boil produced by soda ash and caustic soda to lower the initial nitrogen content during the ladle treatment.

Bibliography

1. L. F. Porter and P. C. Rosenthal, "Effect of Sulphur on Fluidity of Gray Cast Iron," AFS TRANSACTIONS, vol. 60, pp. 611-616, (1952); and "What the Fluidity Test Reveals about Gray Cast Iron," *Foundry*, vol. 81, no. 8, Aug. 1953, pp. 94-99, 245-249.

2. W. W. Levi, "Our Basic Cupola," *The Iron Worker*, Lynchburg Foundry Co., Lynchburg, Va., Spring 1954.

3. J. E. Rehder, "Desulphurizing Gray Cast Iron with Magnesium," AMERICAN FOUNDRYMAN, vol. 18, no. 3, Sept. 1950, pp. 43-49.

4. J. T. Clenny, "Uses for Calcium Carbide in the Iron Foundry," *Pig Iron Rough Notes*, United States Pipe and Foundry Co., Birmingham, Ala.

5. J. M. Crockett and H. E. Henderson, "Calcium Carbide Injection—A New Foundry Tool," AMERICAN FOUNDRYMAN, vol. 25, no. 4, Apr. 1954, pp. 34-43.

6. J. V. Dawson, L. W. Smith, and B. B. Bach, "Some Effects of Nitrogen on Cast Iron," AMERICAN FOUNDRYMAN, vol. 26, no. 1, July 1954, pp. 60-64; and vol. 26, no. 2, Aug. 1954, pp. 43-49.

Published by permission of the Deputy Minister, Department of Mines and Technical Surveys, Ottawa, Ont.

Finalize Pangborn Educational Scholarships

Deed of grant and a plan for awarding more than a hundred scholarships of $500 each were set up recently when Pangborn Corp. officials headed by the founders of the firm, Thomas W. Pangborn, president, and John C. Pangborn, first vice-president, and a delegation of officials of the American Foundrymen's Society led by President Frank J. Dost, president, Sterling Foundry Co., Wellington, Ohio, met in the corporation offices in Hagerstown, Md. Established a year ago and announced at the 1954 AFS Convention by the then president of the Society, Collins L. Carter, Albion Malleable Iron Co., Albion, Mich., the grant of $50,000 was made originally with the stipulation that the benefits were to be made available to castings industry through the chapters of AFS.

Planning Pangborn Scholarship details recently were, front row, left to right: Wm. W. Maloney, AFS general manager, Des Plaines, Ill.; Bruce L. Simpson, president, National Engineering Co., Chicago, AFS vice-president; Thomas W. Pangborn, president, Pangborn Corp., Hagerstown, Md.; John C. Pangborn, first vice-president, Pangborn Corp.; P. J. Potter, vice-president, Pangborn Corp. Back row, left to right, are: Lloyd L. Stouffer, secretary and treasurer, Pangborn Corp.; Thomas Kaveny, Jr., president, Herman Pneumatic Machine Co., Pittsburgh, AFS director; Victor F. Stine, vice-president, Pangborn Corp.; Frank J. Dost, president, Sterling Foundry Co., Wellington, Ohio, AFS president; Collins L. Carter, president, Albion Malleable Iron Co., Albion, Mich., immediate past president of AFS.

Under the plan announced by Thomas Pangborn, ten young men will be selected annually by the Society's Board of Awards from the nominations made of worthy high school graduates by the 42 chapters of AFS. The ten selected will be awarded scholarships with a value of $500 each to be applied as tuition in any technical school offering foundry instruction. No chapter in any one region of the Society will be allowed more than one scholarship until all chapters in that region have participated successfully, except those chapters which make no nominations.

AFS Apprentice Contest Winners Announced

THE outstanding feature of this year's Annual American Foundrymen's Society Apprentice Contest was the capturing of two first places by the Caterpillar Tractor Co., Peoria, Ill. These winners were William J. Cook in the Metal Pattern Division and Frederick S. Moran in the Gray Iron Molding Division.

Mr. Cook entered the four-year Metal Patternmaker's Apprentice Course on July 11, 1951. He received his diploma at the graduation dinner on May 9, 1955. He attened a Peoria grade school and graduated from Woodruff High School in June 1951. While in high school he majored in Industrial Arts.

Mr. Moran was born in Augusta Springs, Va., and attended grade school in Augusta Springs and high school in Craigsville, Va. He served two years, eight months in the U. S. Army Engineers as a bridge builder during World War II. Before entering the four-year Foundryman's Apprentice Course on June 11, 1951, he worked as a chipper in the Cleaning room. He also received his diploma at the graduation dinner, May 9.

In the Steel Division, Richard T. Bernier, Maynard Electric Steel Castings Co., Milwaukee, who placed third in last year's judging, placed first this year. Donald Tetzlaff, Allis-Chalmers Mfg. Co., Milwaukee, was a winner again in the Non-Ferrous Molding Division this year.

The thirty-second annual AFS Apprentice Contest met with its usual outstanding record for competition. This year showed the participation of 14 local chapters, 127 companies and a total of 365 entries, 106 of which reached the final judging at the Navy Pier Branch of the University of Illinois, Chicago, on April 22.

Chapters which sponsored entries included: Canton, Central Ohio, Detroit, Eastern Canada, Michiana, Northern Illinois & Southern Wisconsin, Northeastern Ohio, Quad City, Saginaw Valley, St. Louis, Southern California, Twin City, Washington and Wisconsin.

First place winners in each of the five divisions received $100 and transportation to the Houston Convention, where their prizes were presented by AFS President Frank J. Dost at the Annual Business Meeting. Second and third place winners received $50 and $25, respectively. Results of the national judging are listed below:

First Place Winners

Wood Pattern: Gene Boll, Central Pattern Co., St. Louis,; *Metal Pattern:* William J. Cook, Caterpillar Tractor Co., Peoria, Ill.; *Gray Iron Molding:* Frederick S. Moran, Caterpillar Tractor Co., Peoria, Ill.; *Steel Molding:* Richard T. Bernier, Maynard Electric Steel Castings Co., Milwaukee;

Gene Boll
Wood Pattern

William J. Cook
Metal Pattern

Vincent J. Veneziano
Wood Pattern

Ernest L. Slate
Metal Pattern

Dave Sullivan
Wood Pattern

Stanley Stobierski
Metal Pattern

Non-Ferrous Molding: Chester Boerama, Noren Pattern Manufacturing Co., Fruitport, Mich.

Second Place Winners

Wood Pattern: Vincent J. Veneziano, Model Pattern Co. (M. B. M. Foundry, Inc.) Cleveland; *Metal Pattern:* Ernest L. Slate, Annex Pattern Works, Inc., Cleveland; *Gray Iron Molding:* Stanley R. Varr, Brown & Sharpe Manufacturing Co., Providence, R. I.; *Steel Molding:* Albert Meier, Atlas Foundry & Machine Co., Tacoma, Wash.; *Non-Ferrous Molding:* Oswald Keller, Nordberg Manufacturing Co., Milwaukee, Wisconsin.

Third Place Winners

Wood Pattern: Dave Sullivan, Pacific Car & Foundry Co., Renton, Wash.; *Metal Pattern:* Stanley Stobierski, Cove Pattern Works, Inc., Cleveland; *Gray Iron Molding:* Harold Saunders, John T. Hepburn, Ltd., Toronto, Ontario, Canada; *Steel Molding:* Joseph J. Zohil, Dodge Steel Co., Philadelphia; *Non-Ferrous Molding:* Donald Tetzlaff, Allis-Chalmers Manufacturing Co., Milwaukee.

Competition of this national contest was open to all apprentices, trainees and learners with not more than four years' total experience in the molding trade or those with not more than five years' total experience in pattern making.

Members of the AFS Apprentice Contest Committee which handled the details of the contest were: Chairman, Professor R. W. Schroeder, Foundry and Pattern Design Dept., University of Illinois, Navy Pier Branch, Chicago; Vice-Chairman, George E. Garvey, City Pattern & Foundry Co., South Bend, Ind.; Secretary, A. B. Sinnett, educational director, American Foundrymen's Society, Des Plaines, Ill.; F. W. Burgdorfer, Missouri Pattern Works, St. Louis; D. F. Lane, National Foremen's Institute, New York; Ralph M. Lightcap, Rupp Pattern Co., Rockford, Ill.; W. R. Manske, American Manganese Steel Div., American Brake Shoe Co., Denver, Colo.; Edward J. McAfee, Puget Sound Naval Shipyard, Bremerton, Wash.; V. C. Reid, City Pattern Foundry & Machine Co., Detroit, and G. Ewing Tait, Dominion Engineering Works, Ltd., Montreal, Quebec, Canada.

The master pattern for the molding division of the contest was made through the courtesy of AFS National Director G. Ewing Tait, manager of foundries, Dominion Engineering Works, Ltd., Montreal, Canada. Twenty duplicate aluminum patterns were produced from the master by the plaster mold process at the plant of the Accurate Match Plate Co., Chicago. Miscellaneous cleaning and finishing of the patterns was done by students at the University of Illinois, Navy Pier Branch, through the courtesy of Prof. Roy Schroeder.

First Prize Winners

Frederick S. Moran
Gray Iron Molding

Richard T. Bernier
Steel Molding

Chester Boersma
Non-ferrous Molding

Second Prize Winners

Stanley R. Varr
Gray Iron Molding

Albert Meier
Steel Molding

Oswald Keller
Non-ferrous Molding

Third Prize Winners

Harold Saunders
Gray Iron Molding

Joseph J. Zohil
Steel Molding

Donald Tetzlaff
Non-ferrous Molding

Contest Judges

Judging of this year's contest was handled by: A. B. DiGirolamo, American Brake Shoe Co.; C. G. Mate, Greenlee Foundry Co.; A. C. Den Breejen, Nickel-Straight Foundry Co.; Eric E. Schwantes, International Harvester Co.; J. C. Schrader, Precision Aluminum Foundry; Paul A. Schroeder, Kensington Steel Co.; Sam Eeluscheck, Burnside Steel Foundry; Edward Gricus, Link-Belt Co.; Joseph J. Schallerer, Calumet Pattern Works, Inc.; Robert Wendt, Industrial Pattern Works & Mfg. Co., Inc.; A. Zervenka, ABC Pattern & Foundry Co.; H. K. Swanson, Swanson Pattern & Model Works; J. MacDonald, Pettibone-Mulliken Corp., and R. L. Olson, Englewood Pattern & Model Works. Various crates necessary for shipment of the molding patterns were provided by National Director C. V. Nass, vice-president of Beardsley & Piper, Div. Pettibone-Mulliken Corp., Chicago.

The AFS Apprentice Contest Committee is selecting drawings for molding and patternmaking projects for the 1956 contest. Anyone desiring to propose projects should send drawings to A. B. Sinnett, Educational Director, American Foundrymen's Society, Golf and Wolf Roads, Des Plaines, Ill.

W. L. Leopold

E. J. Metzger

C. J. Egotter

Non-Ferrous Founders Hold Annual Meeting

HERBERT F. SCOBIE / *Editor*

METAL SHORTAGES, cost systems, group insurance, and group research, along with election of officers and directors, highlighted the 12th annual meeting of the Non-Ferrous Founders' Society in Chicago, May 21. Honored at a dinner, in addition to the incoming officers and directors, were members of the original board of directors.

Activities of N.F.F.S. were brought out in the annual reports of board members who reviewed the past year's work at the request of H. A. White, Smeeth-Harwood Co., Chicago, president of the society. Members of the organization can benefit from the insurance program in two ways, Robert Langsenkamp, Langsenkamp-Wheeler Brass Works, Inc., Indianapolis, Ind., said in his report: (1) by joining in the insurance plan which has been especially designed to serve the needs of non-ferrous foundrymen, and (2) by taking advantage of free insurance counselling service available even though the foundry has already adopted some other form of group insurance.

William L. Leopold, Northern Bronze Corp., Philadelphia, later in the day elected president of N.F.F.S. for the coming year, reported that 16 members had been added during the past year and that they along with the rest of the members were profiting from the society's industry surveys, cost program, insurance program, and work of the Washington Contacts Committee.

Cost manual for non-ferrous foundries was revised in June 1954, E. J. Metzger, Multi-Cast Corp., Wauseon, Ohio, incoming first vice-president stated, in reviewing cost activities. He urged staging of cost clinics using information contained in the manuals. W. A. Gluntz, Gluntz Brass & Aluminum Foundry Co., Cleveland, pointed out the importance of knowing costs accurately under normal times as well as under price controls, and indicated that the society was considering developing a cost consulting service.

Reporting on government operations, James W. Wolfe, executive secretary, looked into the future and foresaw standby controls on prices and materials. He reviewed the N.F.F.S. stand on exports and scrap and pointed out that exports should be cut to bring about the traditional price relationships between primary ingot, secondary ingot, and scrap. The question of direct, continued competition between government and commercial foundries is to be considered further, according to vote of meeting attendants.

Mr. White reviewed discussions regarding a proposed product development experimental foundry and reported that these were to be continued for another six months with the idea of developing a concrete proposal for its establishment.

Speaking at luncheon, E. C. Hoenicke, Foundry Div., Eaton Mfg. Co., Detroit, said that castings valued at $140 billion will be produced in the next 20 years provided foundries continue to develop new processes and techniques. Greatest resource of the industry, however, he pointed out, is the quality of its manpower. He cited the work of the Foundry Educational Foundation in developing foundrymen for the future, and urged the support of all foundrymen for the Foundation program.

Volume of group research has about doubled in the past 10 years, David C. Minton, Jr., Battelle Memorial Institute, Columbus, Ohio, stated in outlining a case for group research. Such research today amounts to about $20 million annually. He portrayed the advantages of group research by reviewing the advances in high alloy castings made by the members of the Alloy Casting Institute which developed out of the Alloy Casting Research Institute. These include development of better alloys, standardization of test methods, and writing of specifications. In concluding his address, Mr. Minton gave as the objective of group research "to make more money for the companies participating in research."

Future for brass and bronze foundrymen is bright

continued on page 131

Vacuum solidification test previously limited to estimate has been refined to give measure of dissolved gas

Quick Test for Melt Quality

Measures Gas Content

H. ROSENTHAL / *Metallurgist, Pitman-Dunn Laboratories, Frankford Arsenal, Philadelphia*

S. LIPSON / *Metallurgist, Pitman-Dunn Laboratories*

■ An early reference to a vacuum solidification test is to be found in a 1929 paper by Budgen.[1] His use of the test was purely qualitative. He demonstrated that a gassed metal will form large voids and substantially gas-free metal small voids when subjected to vacuum solidification. The explanation is that precipitated gas will be expanded into large voids by vacuum solidification. Voids caused by unfed volumetric shrinkage in a gas-free melt are not affected by vacuum solidification and are revealed as small scattered voids of the same size as are found in samples solidified at atmospheric pressure.

A more recent reference to a vacuum solidification test is in a 1945 paper by Baker.[2] Here also the test is purely qualitative. The test is used to prove that magnesium alloys are free of gas after certain experimental steps. Baker also proves the presence of gas in instances where he has deliberately gassed the metal beforehand.

The value of the reduced pressure test even on a qualitative basis has been gaining increased recognition and is apparently being used to a significant extent in Great Britain. Research in this field has been in progress at the laboratory of the British Non-Ferrous Metals Research Association.[3,4] This work has resulted in the development of a gas content tester which is being marketed commercially. This apparatus has a means for conveniently solidifying an aluminum sample under controlled reduced pressure. The gas content of the sample is qualitatively determined by examining the appearance of the surface of the sample. A puffed surface is indicative of high gas content and a depressed

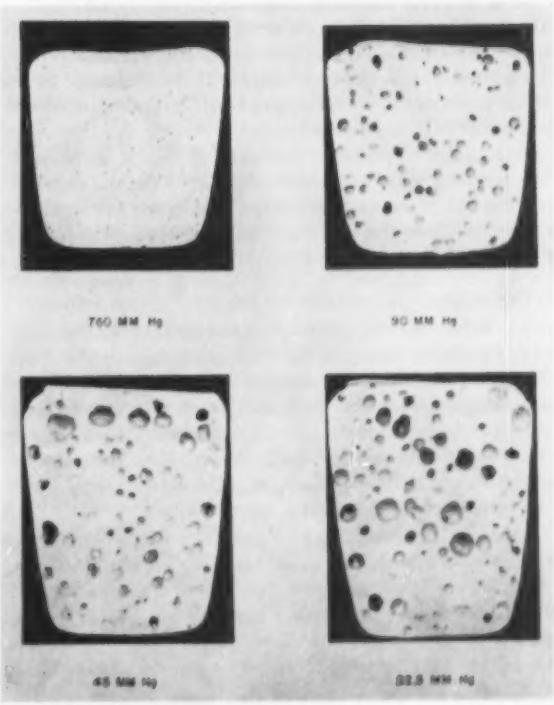


Fig. 1 . . Solidification pressure effects on aluminum alloy No. 85; mold, 1100 F; metal, 1250 F; 3/5 size.

surface of the relative freedom from gas contamination.

In the past year or two, the same type of instrument has been offered on the U.S. market by several American companies. It should be noted, however, that the technique associated with all these commercial instruments is a qualitative evaluation of gas content.

Ohira and Kondic[5] have described a quantitative gas test which makes use of the density measurement of a well-fed atmospherically-solidified test piece as a basis for calculation of the gas content. It is believed that this test does not lend itself particularly to foundry control applications because of: (1) the time consuming nature of the density measurement which is made to an accuracy of ± 0.005 gm/cc and (2) the complicating effect of composition on density as discussed later.

Reduced pressure solidification, however, serves to magnify the effect of dissolved gas on the density of the test sample and in this way reduces the accuracy required of the density measurement. With this relaxation in the accuracy required for the density determination, it becomes possible to speed the density test so that quantitative foundry control of the gas content of aluminum alloy melts is practical. This has also been facilitated by the development of an apparatus for rapid measurement of density.

Apparatus. Figure 2 illustrates the apparatus required for the test. The principal parts, as shown in the schematic diagram, are a vacuum pump, surge tank, manostat and test chamber.

The vacuum pump is a small laboratory mechanical pump having a capacity in the order of 10 cfm. Capacity of the pump is not important; it is used mainly to evacuate the surge tank between tests. The surge tank evacuates the chamber.

Any desired reduced pressure in the surge tank is obtained by appropriately setting the manostat, which controls by a relay the operation of the vacuum pump. This simple mercury-type manostat is adjustable to various positions corresponding to different pressures as indicated on an attached scale.

The reduced pressure chamber in which the sample is frozen is a glass vacuum desiccator. The line connecting the chamber with the surge tank has a fast-opening valve so that the pressure in the chamber can be dropped in less than five seconds.

Operation. A test run by following this sequence:

1. Adjust the temperature of the melt to 1300 F.
2. Partially immerse the specimen cup in the melt. This is done with the mouth end of the cup placed sufficiently above the melt surface so that no metal is permitted to enter until the cup has become sufficiently preheated. The cup is then removed from the preheating spot and submerged to take the sample.
3. Place sample into the test chamber.
4. Close the chamber and open the valve connecting the chamber with the surge tank which has been previously evacuated to a given setting of the manostat.
5. Give the sample ingot time to solidify at the reduced pressure. (The pressure selected in this experimental work was approximately 1/8 of an atmosphere).
6. Measure the density of the ingot.
7. By comparison with the standard density of a gas-free ingot, compute the volume of gas in the ingot.

Density Measurement. The density of the sample ingots was measured by means of a gravitometer developed for this specific application.[6] This apparatus permits determination of the density of aluminum samples within 30 seconds. The apparatus consists of a cylinder which contains two immiscible liquids, the lighter liquid floated above the heavier liquid. Mercury and ethyl alcohol were used in this case. A specimen submerged in the alcohol will float upon the surface of the mercury. The density of the specimen is calculated from the relative displacements occurring in each liquid. The reproducibility of this instrument was found to be better than ± 0.02 gm/cc when measuring the aluminum sample ingots obtained with the reduced-pressure test.

This gravitometer was developed to satisfy the need for rapid density measurement required for production control applications. Although the conventional technique of weighings in air and liquid is inherently a more sensitive method for measuring density, the nature of the reduced-pressure test specimen is such that the potential accuracy of the method cannot be realized. The surface of these specimens frequently contains pores or openings which connect with internal voids caused by gas precipitating during solidification. Seepage of the liquid into these voids makes the determination of the balance point difficult. While the same seepage occurs in the gravitometer apparatus, the rapidity of the test tends to reduce the error attributable to this source.

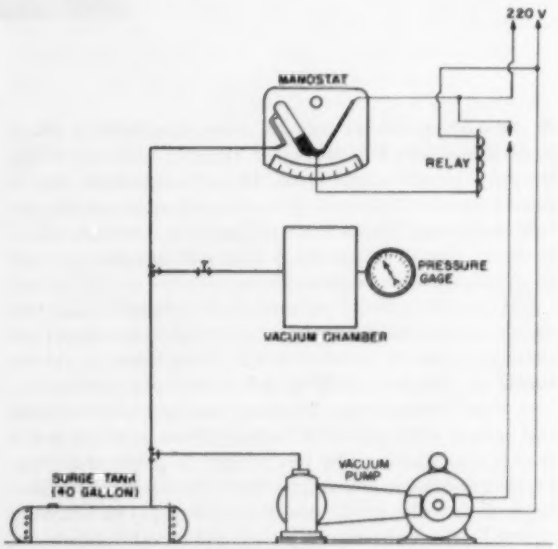


Fig. 2 . . Diagram of reduced pressure test apparatus.

Calculation of Gas Content. The volume of gas in the sample ingots is calculated from the measured density of the sample and the standard density of a gas-free ingot. The derivation of the formula follows:

Let D = Density of sample ingot

D_0 = Density of gas free ingot

$$D = \frac{\text{weight}}{\text{volume}}$$

$$\frac{1}{D} = \frac{\text{volume}}{\text{weight}} = \frac{\text{volume (metal)} + \text{volume (gas)}}{\text{weight (metal)} + \text{weight (gas)}}$$

Since the weight of the gas can be neglected,

$$\frac{1}{D} = \frac{\text{volume (metal)}}{\text{weight (metal)}} + \frac{\text{volume (gas)}}{\text{weight (metal)}}$$

$$\frac{\text{volume (gas)}}{\text{weight (metal)}} = \frac{1}{D} - \frac{1}{D_0}$$

$$\text{cc gas per 100 g metal} = 100\left(\frac{1}{D} - \frac{1}{D_0}\right)$$

Since the gas which formed the voids in the sample was precipitated at 90 mm Hg and at the freezing temperature of the alloy (521 C), the volume of gas at standard conditions of pressure and temperature (STP) must be corrected in accordance with Boyle's and Charles' laws.

$$\text{volume (STP)} = \left(\frac{90}{760}\right) \times \left(\frac{273}{794}\right) \times \text{(measured volume)}$$

$$\text{volume (STP)} = 0.0408 \times \text{(measured volume)}$$

$$\text{cc gas per 100 gm metal (STP)} = 4.08\left(\frac{1}{D} - \frac{1}{D_0}\right)$$

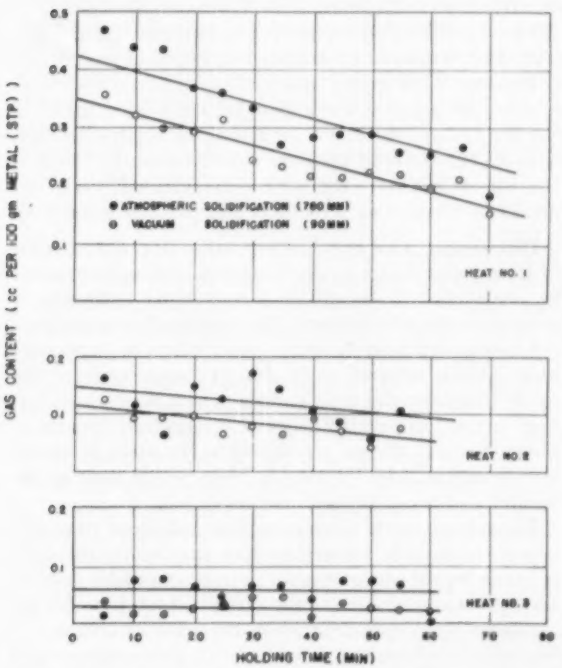


Fig. 3 . . Graph of data used to calibrate test.

Solidification Pressure. Consideration was given to the effect of the geometry of the sampling cup on the retention of gas within the sample. The ratio of free surface area to the volume of the sample should have an important bearing on the gas loss which occurs. The thin, drawn-steel cup which was adopted for this work was one whose length was approximately three times the inside diameter (⅞ in.). Sectioned specimens made in this cup are shown in Fig. 6.

The selection of a solidification pressure for the test is related to the sensitivity required. With lower pressures the volume of gas lost from the sample is increased. The mechanism by which some of the gas contained in the sample is lost in the course of the test is discussed later. When the reduced-pressure test is employed on a qualitative basis for low gas content aluminum, it is necessary that low solidification pressure be used to realize the required sensitivity. Dardel[7] notes that French foundrymen most commonly use pressures of 1/760 atmosphere.

By employing a density measurement to provide quantitative data, it has been found that approximately ⅛ atmosphere provides sufficient sensitivity for most foundry test purposes. This permits a workable degree of sensitivity for purposes of density measurement without excessive gas loss from the sample.

Figure 1 shows a series of aluminum ingots solidified under various pressures. These specimens, containing essentially the same amount of gas, were prepared in the course of preliminary work on this program. This series shows the effect of solidification pressure on the size and distribution of gas holes. The sampling cup was a 4/0 clay-graphite crucible preheated to 1100 F. used for these specimens.

Calibration. The procedure used to calibrate the test was to pour two test ingots from a given melt at the same time. The first ingot was solidified under atmospheric pressure, the second in the reduced pressure chamber.

Three melts having varying amounts of dissolved gas were prepared and periodically sampled in this manner. The density of the atmospherically solidified sample was determined by the conventional method of weighing in air and ethyl alcohol. Density of reduced pressure samples was measured in the gravitometer.

The data obtained were plotted in Fig. 3. The ordinate scale represents cc gas/100 gm metal at STP and the abcissa represents holding time. The gas contents calculated from the atmospherically-solidified samples were consistently higher than the gas contents calculated from the reduced-pressure samples. This error is in a direction which would indicate that gas is evolved and lost from the sample during reduced-pressure solidification. At higher levels of gas content, the divergence of the data is greater than for lower gas contents.

It was assumed for purposes of computation that the data plotted in Fig. 3 represent straight line functions. The equation of the best fitted line for each set of data was determined by the method of least squares.

It is apparent that the slopes of the paired lines of each heat are nearly equal. This indicates that some systematic error is present which is responsible for the difference in the paired lines. It is also apparent that this difference is due to a regular loss of gas from the specimens solidified at reduced pressure.

It is a relatively safe assumption that the gas content calculated from atmospherically-solidified samples is very close to the actual gas content as shown by Ohira and Kondic.[5] It should then be possible to compute a correction factor which could be applied to the data obtained from the samples solidified at reduced pressure so that values would be substantially equal to values for specimens solidified at atmospheric pressure.

Examination of the data plotted in Fig. 3 indicates that the magnitude of the systematic error is dependent upon the gas content of the specimen. The shift of the paired lines is greatest for the heats containing the most gas. In order to make the best estimate of the correction

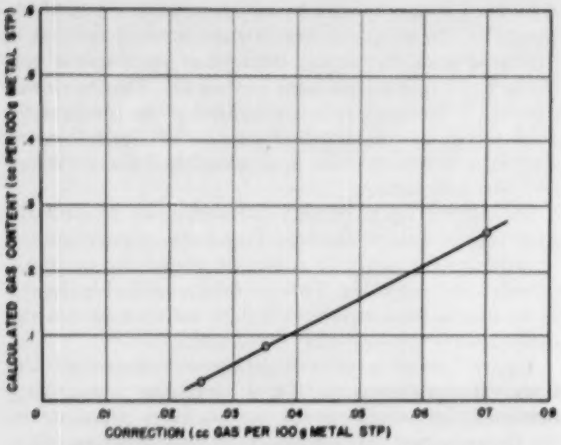


Fig. 4 . . Gas content correction applied to test.

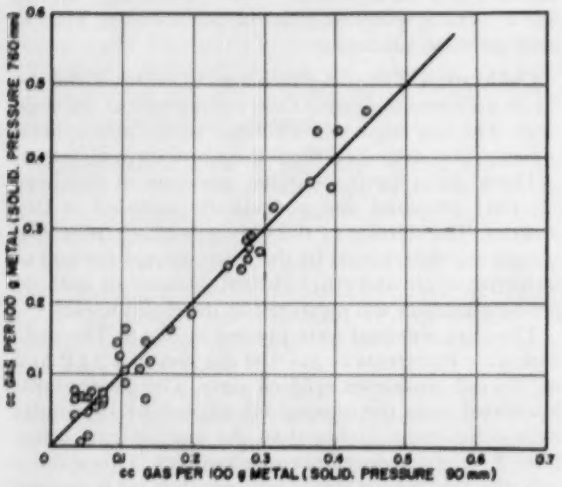


Fig. 5 . . Data points show conformance to Boyle's law.

to be applied at various gas levels, the shift in the paired lines was measured at the center of the holding time axis. The distance between each set of lines was plotted in Fig. 4 versus the gas content corresponding to that indicated by the reduced-pressure solidified samples at these points. Figure 4 then shows the magnitude of the correction to be applied to the gas content indicated by each specimen solidified at reduced pressure.

It would be expected that the line in Fig. 4 would intersect the origin of the graph if the total correction were due solely to loss of gas from the sample. Obviously, a melt which is initially free from gas would produce a specimen of constant density, irrespective of the solidification pressure. The shift of this line from the origin could easily be due to the acceptance of an incorrect value for the true density of the alloy. An error of 0.01 gm/cc in this estimate would be sufficient to account for this error.

All of the reduced-pressure data points were corrected in accordance with the correction indicated by Fig. 4, and replotted in Fig. 5. Each point in the figure was obtained from the two companion specimens. The ordinate represents the calculated gas content of the atmospherically-solidified sample and the abcissa the calculated (corrected) gas content for the sample solidified at reduced pressure. A 45° line having its intercept at the origin was drawn to represent the theoretical line upon which all the points should fall.

The fit obtained is reasonably good and demonstrates that a reliable relationship exists between the density value obtained from a specimen solidified at atmospheric pressure and the corrected density value obtained from a specimen taken from the same melt at the same time and solidified at reduced pressure.

Although specimens which have been solidified at atmospheric pressure can be used to make a semi-quantitative estimate of gas content, the reduced-pressure specimen is, in fact, essential to the successful application of a foundry control test for the following reasons:

1. Without the enlargement of the gas bubbles caused by reduced-pressure solidification, it would be necessary to employ the prohibitively time-consuming conventional method for density measurement in order to achieve the required accuracy.

2. Calculation of the gas content from a density measurement requires a knowledge of the true density of the alloy. Due to compositional variations within specification limits, a certain amount of variability of true density exists for a given alloy. For example, Alloy No. 195 has specification copper limits between 4 and 5 per cent. This results in a calculated variation in true density between 2.798 gm/cc and 2.822 gm/cc. Such a variation would account for a possible error of ± 0.045 cc gas per 100 gm metal for an atmospherically-solidified sample. For reduced pressure solidification at 100 mm Hg, the error due to the same compositional variation would be limited to ± 0.006 cc gas per 100 gm metal.

Discussion. The equilibrium solubility of hydrogen in liquid aluminum under ordinary atmospheres must be considered to be nil since very little hydrogen is present in the atmosphere. The approach to equilibrium in a gassed heat has been observed to be extremely slow. This is believed to be due to the presence of the oxide film over the melt surface which forms an effective barrier limiting diffusion of the gas into the atmosphere. Some of the gas contained in the melt, however, may be released by forming bubbles which float to the surface and break through the oxide film.

Experience with aluminum has indicated that this process of bubble formation may start while the melt is in the liquid phase. Nuclei to initiate bubbles are always present in the melt; the rate at which bubbles are formed being dependent upon the state of saturation. Foundrymen have long observed this phenomenon and many references may be found to show that allowing the melt to stand for a time before pouring results in a decline in the gas content. Figure 3 shows that hydrogen is given off more rapidly the higher the initial gas content of the heat.

Allen[8] has shown that the spontaneous formation of a bubble is governed by the relationship:

$$\Phi = P + \frac{2T}{r}$$

where Φ is the pressure on the bubble within the melt, P is the hydrostatic pressure of the molten metal plus the pressure of the atmosphere above it, T is the surface tension of the metal, and r is the radius of the bubble. When a sample of metal is solidified under re-

duced pressure, the value of P is decreased. This in turn reduces Φ which means that bubbles are formed more easily. At the same time, bubbles which are formed under conditions of reduced pressure are larger and more buoyant. They rise faster through the metal and their escape is thus facilitated. These factors explain why more gas is lost from the reduced pressure samples than from those at atmospheric pressure.

Higher temperatures would mean the sample would be in the completely liquid phase for a longer period and, since the loss of gas is a function of time as well as state of saturation, more gas bubbles would be evolved during the period when they can easily escape.

The principal means by which bubbles are trapped is due to the formation of dendrites during freezing. These dendrites result in a mushy condition which effectively prevents the bubbles from moving through the remaining liquid. Fortunately, most of the gas is rejected from the liquid during the freezing process. A sharp decline in solubility occurs at the freezing point of the metal[9] which results in a rapid enrichment of the interdendritic liquid with gas thus promoting bubble formation. Development of the dendritic network provides additional nuclei to initiate bubble formation.

Although this work covered a wide range of gas contents, the chief utility of the semi-quantitative test is in the range that would correspond to a gas level not exceeding that found in Heat No. 3 (Fig. 3). Severely gassed metal can be easily detected by the reduced pressure test on a qualitative basis. This is apparent by examination of Fig. 6 which shows a number of samples taken from melts of a wide range of gas contents. The qualitative evaluation can be made without sectioning. The appearance of the free surface of the sample ingot is convex if severe contamination exists and changes to concave where moderate quantities of gas are present.

The quantitative test differentiates between what might be regarded as heats of low gas content and heats which are substantially free from gas. Another field of usefulness for the quantitative test would be for control purposes in those instances where gas is deliberately added to aluminum before casting. This is sometimes done both for sand and permanent mold castings which cannot be adequately fed.

All the work described in this report concerned the 5 per cent Si, 4 per cent Cu aluminum alloy. Similar tests run with other compositions having mushy solidification ranges indicate they are amenable to the test.

It should be clearly understood that not all of the procedures described in this paper are necessary for the routine operation of the test. In establishing the validity of the test, it was necessary to relate the experimentally determined gas content figures as precisely as possible to the absolute gas content of the heat.

However, for foundry control purposes, the directly determined density reading should be sufficient. This reading will easily discriminate between heats which are completely degassed as compared to those with a low but appreciable residual gas content. In other instances, it may be desired to maintain a given level of gas content in the metal in order to distribute shrinkage unsoundness in only partially-fed castings. In this case, the desired effect in a given casting can be correlated directly with the density test readings.

Conclusions. It is concluded that:

1. Under standardized conditions of testing a correlation can be established between the density of atmospherically-solidified samples of aluminum alloy and the density of companion specimens taken from the same heat at the same time and solidified at reduced pressure.
2. The volume of gas lost during reduced-pressure solidification is related to the initial melt gas content.
3. Reduced pressure solidification is essential to a rapid quantitative gas test for aluminum.

Acknowledgment. The authors are indebted to the Department of the Army for permission to publish this report. Opinions expressed are the authors and are not necessarily endorsed by the Dept. of the Army.

References

1. N. F. Budgen, "Pinholes in Cast Aluminum Alloys," *J. Inst. Metals*, vol. 42, pp. 119-140 (1929).
2. W. A. Baker, "Microporosity in Magnesium Alloy Castings," *J. Inst. Metals*, vol. 71, pp. 165-204 (1945).
3. Anon. "Gas Content Control," *Light Metals*, pp. 306-307, Sept. 1952.
4. D. P. Sparham, and E. A. Molt, "Experiences in Degassing Aluminum Alloys," *Foundry Trade J.*, pp. 777-781, Dec. 1953.
5. G. Ohira and V. Kondic, "Testing the Gas Content of Molten Metals," *Foundry Trade J.*, vol. 96, no. 1960, pp. 331-333, Mar. 25, 1954.
6. S. Lipson, A. Saia, and H. Rosenthal, "Gravitometer for Rapid Density Measurement of Solids," *ASTM Bulletin*, (1955) (In process of publication).
7. Y. Dardel, "Hydrogen in Aluminum," *Trans. AIME*, vol. 180, pp. 273-286, (1949).
8. N. P. Allen, "The Effect of Pressure on the Liberation of Gases from Metals," *J. Inst. Metals*, vol. 71, pp. 317-362 (1945).
9. C. E. Ransley, H. Neufeld, "The Solubility of Hydrogen in Liquid and Solid Aluminum," *J. Inst. Metals*, vol. 74, pp. 599-620, (1948).

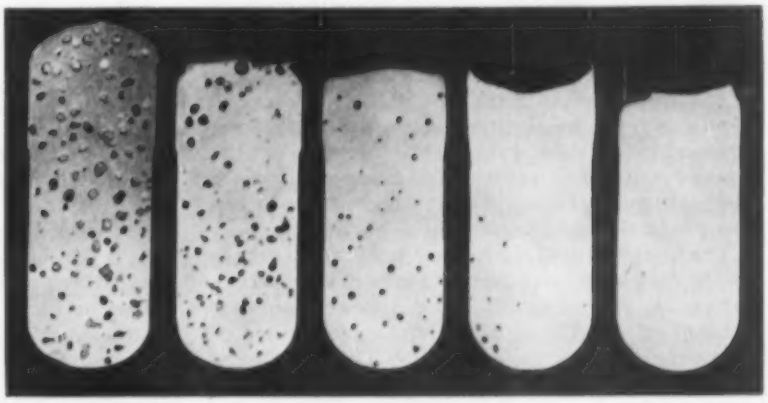


Fig. 6 . . Severely gassed metal can be detected easily on a qualitative basis. From left to right, solidified at 90 mm Hg:

Density (gm/cc)	cc Gas/100 gm metal
2.357	0.29 STP
2.529	0.15 STP
2.714	0.03 STP
2.742	0.015 STP
2.789	0.0 STP

W. E. TRACY / *Application Engineer*
Sturtevant Div., Westinghouse Electric Corp.
Chicago

DO'S and DON'TS of FAN CONNECTIONS

■ The trend toward streamlined, mechanized foundry operation emphasizes the necessity of re-evaluating accessory equipment. The increased speed of the operations has created additional problems not considered important when production was limited. Some occupational hazards incident to normal foundry practices have been multiplied. It is desirable to review these conditions in order to promote still higher production and to upgrade the general plant atmosphere.

The exhaust fan is one of the accessory pieces of equipment that is becoming more prominent in foundry considerations. The fan industry has been keeping abreast of the changing times, and the present day industrial exhauster is a far cry from previous models. It, too, has become more efficient and adaptable for the various applications to which it is subjected. It is capable of handling greater loads under more severe conditions and at higher efficiencies than ever before.

The application of a fan to a system of duct work requires careful consideration on the part of the foundry engineer and the fan supplier. A complete exhaust system consists of two elements or components, and a thorough understanding of each is necessary to be sure that the final desired results will be obtained.

The first element of the system consists of the exhaust hoods, duct work, and dust collectors. The characteristics of the flow of air through this element are independent of the exhaust fan (although in a complete system the fan does create the flow). The resistance to flow of air through the duct work, hoods, and most collectors varies as the square of the volume of air flow. It is possible to illustrate a system graphically as indicated by Fig. 1. Notice that the resistance to air flow rises steeply as the volume increases and, therefore, the simplest system arrangement is necessary because high resistance is reflected directly by high fan horsepower.

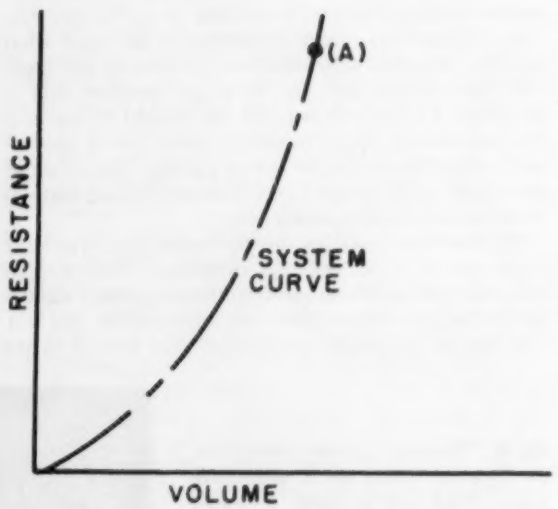
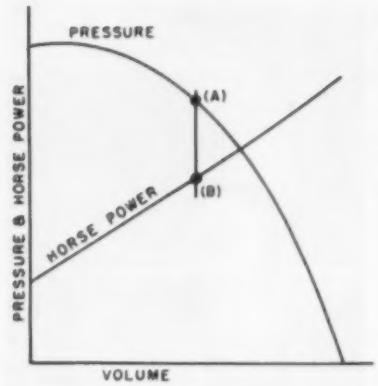
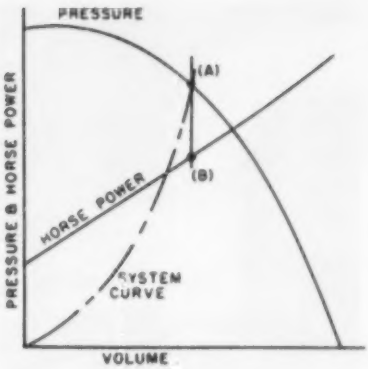


Fig. 1 . . Characteristics of a duct work system shows resistance to increase rapidly as volume increases.

In actual practice the foundry engineer will deter-





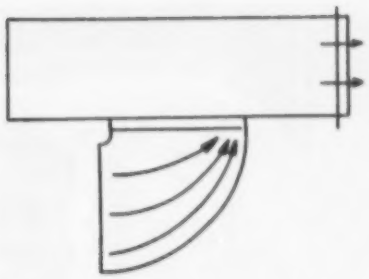
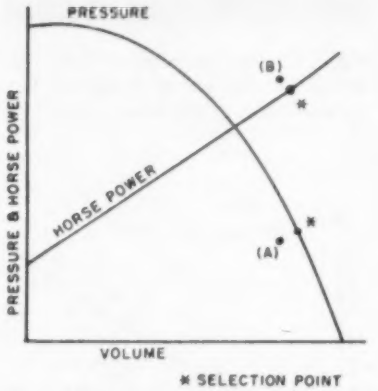
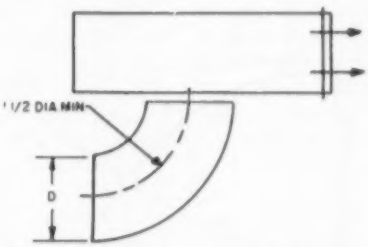


Fig. 3 (above left) . . Relationship of fan and duct characteristics shows horsepower required for system.

Fig. 2 (above left) . . Performance characteristics of a typical "paddle wheel"-type exhaust fan.

Fig. 4 (above) . . Short radius elbow on fan inlet concentrates air and loads the fan wheel unevenly.





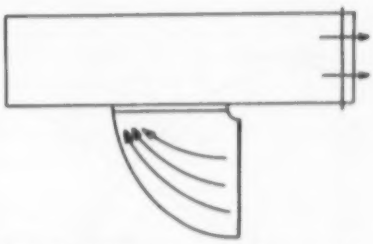


Fig. 5 . . Short radius elbow at fan inlet reduces fan performance and increases horsepower.

Fig. 6 . . Move elbow from fan or increase centerline radius to 1 ½ pipe diam. to relieve elbow troubles.

Fig. 7 . . Horsepower, volume, and pressure of this arrangement would be below basic fan curves.

mine the volume of air necessary to remove the various dusts and contaminants from the source of trouble, then locate his exhaust fan and dust collector, connecting them with the hoods by means of sheet metal duct work. Having calculated the resistance of the system, he will have established a point of desired operation on the system curve (Point *A*, Fig. 1).

Second Element Is Exhaust Fan

The second element of the complete system is the exhaust fan which forces the air to flow through the system. The performance characteristics of a fan are illustrated graphically in Fig. 2. These curves relate the volume of air delivered to the pressure rise and the driving horsepower required and are drawn for any convenient fan speed. Note that as the volume delivered by the fan increases, the pressure rises to a peak and then drops rapidly to zero when the fan is delivering its maximum volume. The horsepower rises as the volume increases. The curves of Fig. 2 illustrate a typical "paddle wheel" or industrial fan used in foundries. Other types of fans have different characteristics which may make them more applicable depending upon the duty involved.

The established volume and resistance mentioned above is given to the fan supplier who refers to tabulated data and determines the proper fan selection. Actually his selection is only one point on the fan characteristic curves (Points *A* & *B*, Fig. 2).

When the fan is installed on the system of duct work the two elements of the complete system have been brought together. Reference to Fig. 3 indicates the graphical relationship of the two elements. Note that the system curve crosses the fan characteristic pressure curve at only one point (Point *A*). This point is the required volume and resistance to air flow established by the foundry engineer and given to the fan supplier. Point *B* represents the horsepower required to drive the fan in order to force the required air volume through the system.

When the engineering has been done well by both parties, and the duct work and accessory equipment installed correctly, the complete system will remove the desired volume of air from the source of trouble. It sometimes develops, however, that discrepancies arise and the system does not function as designed. Investigations have quite often determined that faulty connections to and from the fan may influence its performance. It is impossible to establish accurate engineering data concerning the effect of poor connections without extensive research. This discussion, therefore, will review only in general terms the "do's" and "don'ts" of fan connections.

Strictly speaking, poor outlet connections do not affect the performance of the fan because the air has already passed through it. However, these connections do add turbulence to the air flow which cannot be determined. Accordingly the resistance of the system is

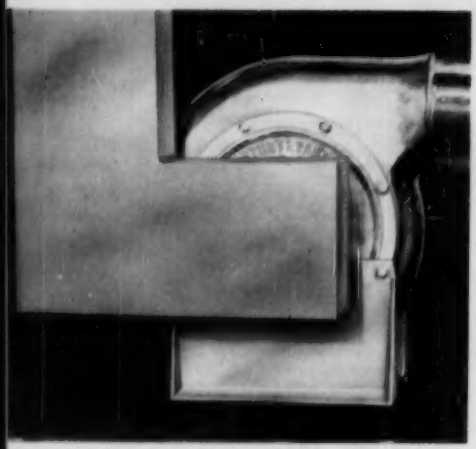


Fig. 8 . . Offset rectangular connection is undersized and not vaned; allows heavy particles to settle out.

Fig. 11 . . Short radius elbow on discharge outlet tries to reverse the direction of air from that of the fan.

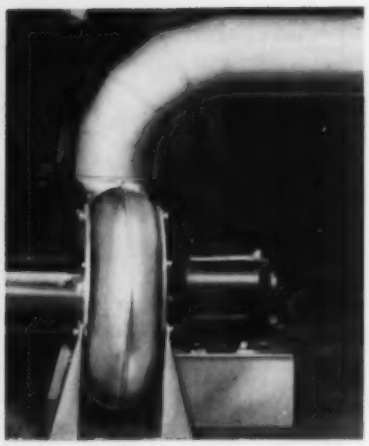


Fig. 14 . . This installation does not allow exhaust air to straighten out before entering the close elbow.

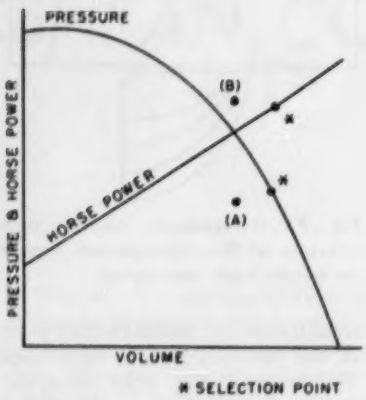


Fig. 9 . . Box connection reduces volume and pressure delivered by fan, and increases horsepower requirements (Points A and B).

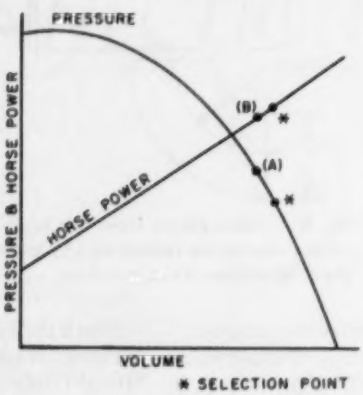


Fig. 12 . . Above installation creates turbulence in short elbow reducing volume, increasing pressure, and decreasing horsepower.

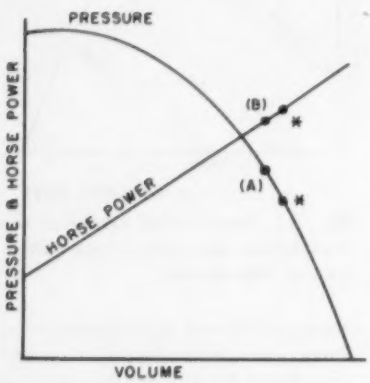


Fig. 15 . . Turbulence introduced by the above arrangement reduces volume and horsepower, and increases pressure slightly.

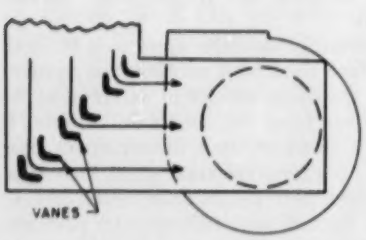
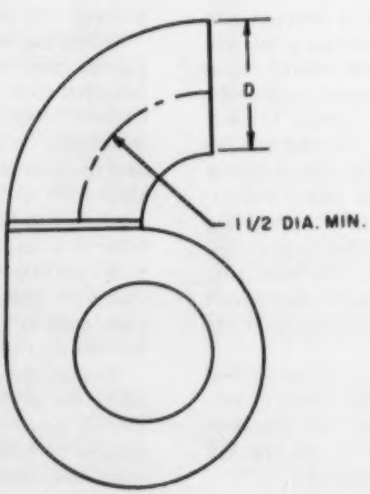


Fig. 10 (above) . . To increase air volume, increase the box size and add vanes to straighten out air.

Fig. 13 (right) . . Move elbow from fan outlet, rotate fan housing in the direction of elbow, or turn fan around so that air leaving the wheel is thrown down the elbow.



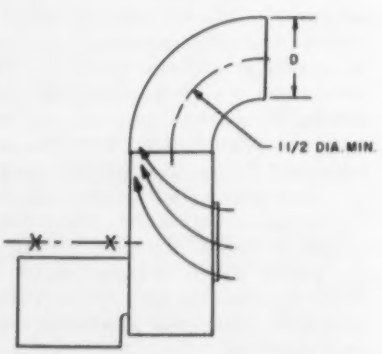


Fig. 16 . . Moving the elbow five to ten diameters from fan will allow air to straighten out and eliminate turbulence. A fan of opposite rotation may also be used to advantage.

higher than calculated and therefore the fan does not deliver the desired air volume. The effect of these poor elbows has been included in this discussion inasmuch as the performance of the complete system is affected.

Figure 4 illustrates a short radius elbow connected to a fan inlet. Inasmuch as air has mass, it will tend to concentrate at the far side of the elbow and will therefore load the wheel unevenly. Such an arrangement will reduce the performance of the fan, i.e. lower the volume and pressure delivered (Point *A*, Fig. 5) and at the same time raise the horsepower slightly (Point *B*, Fig. 5). To relieve this condition it is necessary to move the elbow back away from the fan inlet approximately five or ten pipe diameters. Such an arrangement will allow the air to straighten out before it enters the inlet. If the above changes are impossible, then the centerline radius of the elbow should be increased to a minimum of 1½ pipe diameters (Fig. 6).

If the elbow had been connected to the fan as shown in Fig. 7, then the horsepower, as well as the volume and pressure, would have been below the basic fan curves. To improve the fan performance, the same suggestions as given in the paragraph above will apply.

Undersized Connection Not Vaned

The writer recently observed an installation as shown by Fig. 8. Such an arrangement with an offset rectangular connection is poor practice. The connection was undersized and was not vaned. The volume of air being exhausted was considerably lower than that desired. Because the connection was smaller than it should have been, the velocities of air were higher and the losses were greater than calculated. Furthermore, the air entered the fan inlet with a spin counter to the rotation of the wheel. Since fan performance is based upon the air entering the inlet in straight lines, it is obvious that the volume of air delivered was affected.

Fortunately this fan was handling clean air; otherwise, dust might have settled out in the rectangular connection. The effect of a connection such as this is to reduce the volume and pressure delivered by the fan (Point *A*, Fig. 9) and increase the horsepower as illustrated by Fig. 9, Point *B*.

In order to increase the volume of air exhausted by this system, it was necessary to increase the size of the rectangular inlet box and to install turning vanes in the elbow to make sure that the air entered the fan inlet in straight lines (Fig. 10). The width of the inlet box across the fan inlet should be a minimum of one wheel diameter, and the box should extend out from the inlet at least one-half a wheel diameter.

If the shape of the inlet box had been such that the air was given a spin in the direction of the rotation of the wheel, then the volume and pressure delivered by the fan would be reduced, together with the horsepower required to drive the fan.

Quite often an installation is encountered wherein a short radius elbow is placed immediately at the fan discharge as illustrated by Fig. 11. The air leaving the fan outlet is still rotating in the direction of the wheel. An elbow of this arrangement is trying to reverse the direction of air flow; thus it creates a large amount of turbulence at this point. This turbulence represents a loss of energy which cannot be calculated and, therefore, the volume of air delivered by the fan is reduced, although the pressure is higher (Point *A*, Fig. 12). The horsepower follows down its curve as illustrated by Point *B*, Fig. 12.

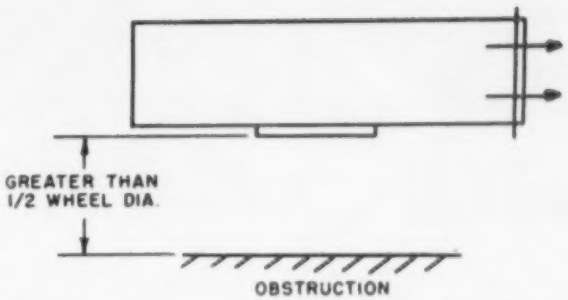


Fig. 17 . . Volumes are reduced when the inlet is less than one-half the wheel diameter from an obstruction.

It is suggested that the elbow be removed from the fan outlet to a distance of approximately five to ten pipe diameters. The air will be flowing in relatively straight lines as it approaches the elbow and accordingly the loss due to turbulence will be eliminated. Another suggestion is to rotate the fan housing 45° or 90° in the direction of the elbow, thus reducing the angle of the elbow or eliminating it altogether. Again the fan may be turned around so that the air as it leaves the wheel will be thrown directly down the elbow, eliminating the turbulence. The centerline radius of the elbow should be a minimum of 1½ pipe diameters (Fig. 13).

The writer has seen installations illustrated by Fig. 14. Such an arrangement again introduces turbulence in the elbow and accordingly the volume is reduced, the pressure is slightly higher indicating this loss (Point *A*, Fig. 15), and the horsepower required to drive the fan is reduced along its curve (Point *B*, Fig. 15).

Moving the elbow five to ten pipe diameters away from the fan outlet will allow the air to straighten out and this turbulence will be eliminated. A second solution is to use a fan of opposite rotation which will allow the air to enter the elbow without a change in direction. The minimum radius of elbow should be 1½ pipe diameters (Fig. 16).

Cannot Obtain Required Air

Open inlet ventilating fans are often installed in small penthouses or factory areas where there are obstructions that may partially block the inlet. Such a condition will obviously not allow the fan to obtain the air required and therefore its delivered volume will be reduced. Laboratory tests indicate that the fan volume begins to be reduced when the fan inlet is less than 50 per cent of the wheel diameter away from the penthouse wall or other obstruction. A good rule of thumb is to make sure that any obstruction is at least one-half the wheel diameter away from the fan inlet (Fig. 17).

There are, of course, many variations of the above connections. However, a knowledge of the effect of the basic connections will be of assistance when these problems arise. Fan suppliers are generally in a position to be of assistance in the design of the system, and they will welcome the opportunity to be of service.

DONALD M. MURRAY / *Chief Chemist*
Albion Malleable Iron Co., Albion, Mich.

How to Measure

Molding Sand Blowability

■ A recent interesting development in green sand molding has been the blow-squeeze machine which makes molds rapidly and lends itself to stack molding, allowing high mold production without skilled labor. In view of the advantages, Albion Malleable Iron Co. installed one of the first integrated units in the country for blow-squeeze stack molding.

Early work with the unit indicated that present knowledge of factors which evaluate the suitability of a sand for blowing is inadequate and a new concept of blowability was introduced. Since no standard tests for blowability were available, it was necessary to decide how blowability could be evaluated, before the investigation could proceed.

Originally it was hoped that mold hardness of a blown mold could be used as an index of blowability of a sand. Such was not the case, however, since generally any sand which blew gave about the same mold hardness with a given blow plate and at a given pressure. Also, there were always wide variations of hardness within a mold. It is felt that, regardless of whether the blown mold hardness is high or low, the important factor is the ability to fill the flask with sand since it should be possible to achieve final mold hardness with the squeeze cycle of a production machine.

A cartridge bench core blower was used to blow sand into a core box whose cavity measured approximately 4x5x¾ in. deep. (Fig. 1a & b). The standard blow plate had six ⅜-in. blow holes. Air supply was through a ¾-in. line at 90 psi maximum pressure but could be decreased through a regulator.

Fig. 1a . . Cartridge and core box used to test blowability.

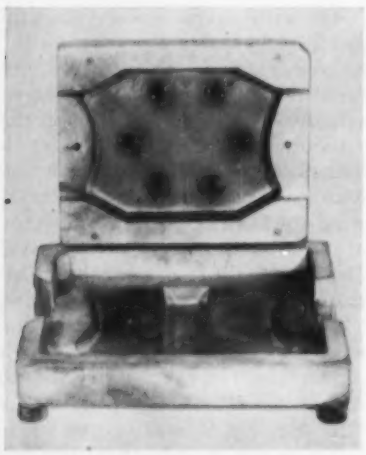


Fig. 1b . . Standard blow plate with six ⅜-in. blow holes.

Ability to fill the core box with sand varied from one blow to the next and from one sand to another. A blow was judged good, fair, poor, or impossible depending upon results obtained in the mold and in the blow cartridge. For example, a sand with good blowability was one which completely filled the mold with each blow, did not channel in the magazine, and which required no special preparation of sand in

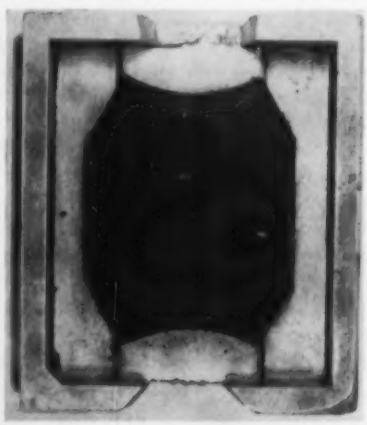


Fig. 2 . . Test mold which blew out due to channeling in magazine.

the magazine in order to get it to blow consistently.

Blowability was rated fair if a full mold could be blown only occasionally. Usually this sand tended to channel in the magazine, making it necessary to break up channeling mechanically before a second mold could be blown. A sand with poor blowability was one which channeled to the extent that a full mold could not be blown, regardless of the attention given to sand in the magazine initially. Figure 2 shows a mold which blew out and did not fill completely due to channeling in the magazine. A rating of impossible was given to a sand which merely packed in the magazine; that is, no channeling occurred nor was any sand blown into the mold.

An attempt was made to correlate physical properties with blowability in order to predict blowability from conventional green sand properties. Moisture was plotted against green compression strength, permeability, deformation, Dietert flowability, and various combinations of these properties. None of the plots gave satisfactory comparisons. Table 1 shows the grain distribution of base sands used in blowability tests.

Rating Molding Sand Blowability

No single property indicates blowability of molding sand.

Most blowable sand is one with minimum bond strength. But higher compression strength alone doesn't make sand difficult to blow.

Optimum moistures for molding are generally hardest to blow.

Better blowability can be obtained by increasing blow pressure, increasing size of air lines, or by changing number, location or size of blow holes.

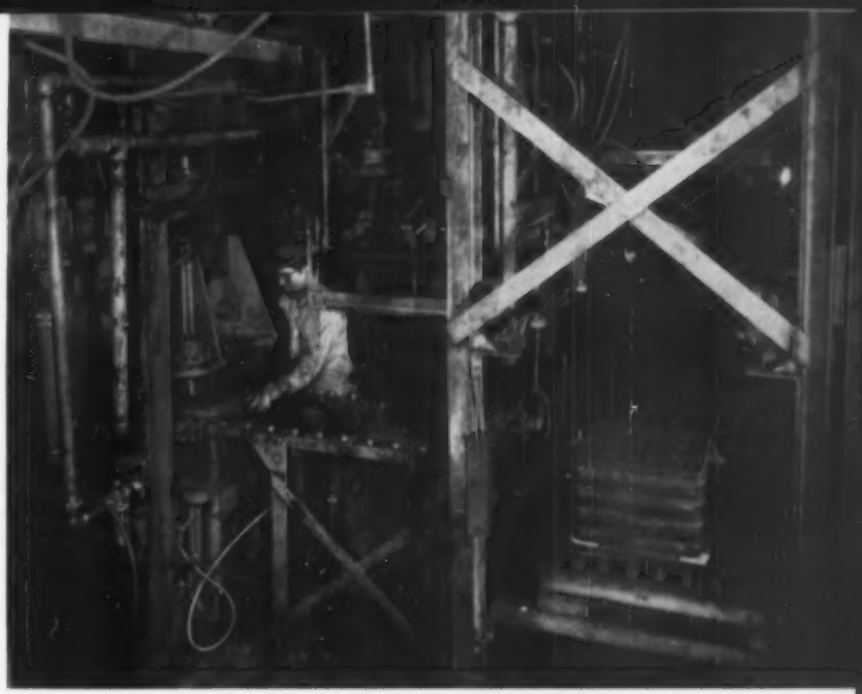


Fig. 3 . . Mold blowing machine, left; automatic stacker, right.

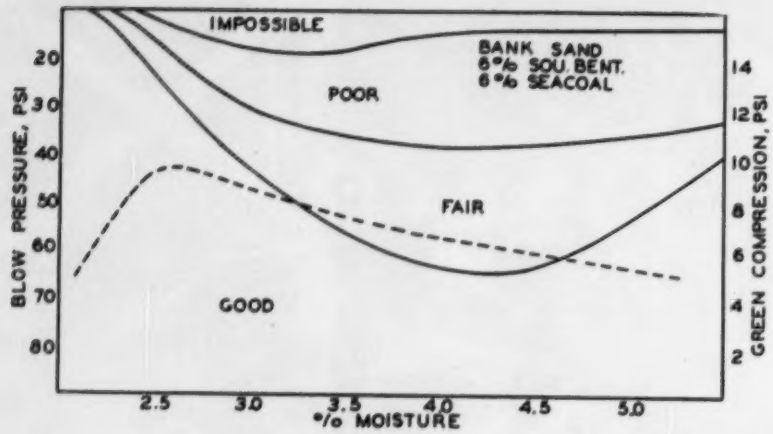
The most useful method found for evaluating the blowability of a sand-clay mixture was to compare one mixture with another over a range of moisture. Blowability was judged at blow pressures from 90 psi to 10 psi at each of several moistures. Results were combined to form a chart similar in appearance to a phase diagram. Curves on the charts are not definite divisions such as are found on a phase diagram but rather they are general transition ranges. Charts generally can be duplicated by one operator, but the judgment of blowability or technique of another operator might produce a significantly different chart. Table 2 shows experimental data (one of ten test series) for constructing each chart. The six numbers below each pressure are six hardness readings on the blown mold. Below them is the average of the six and below that is the blowability rating at that particular pressure.

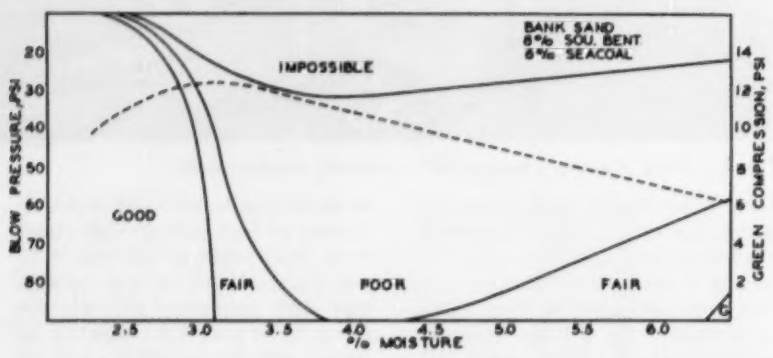
New sand was used in all experiments with standard additions of six per cent seacoal and varying amounts of clay. Percentages of additions, where indicated, are per cent by weight of sand in the mix. The mixing cycle was two minutes dry and three minutes wet (unless otherwise noted) in an 18-in. laboratory mixer. It was not intended that all of the mixtures made would be good for molding since there are sands in each series which would be too dry or too wet for successful molds. Probably any mixture can be blown if it is wet enough or if it is dry enough, although extremes in moisture would be necessary when bond is high. Optimum moistures for molding were generally those which were hardest to blow.

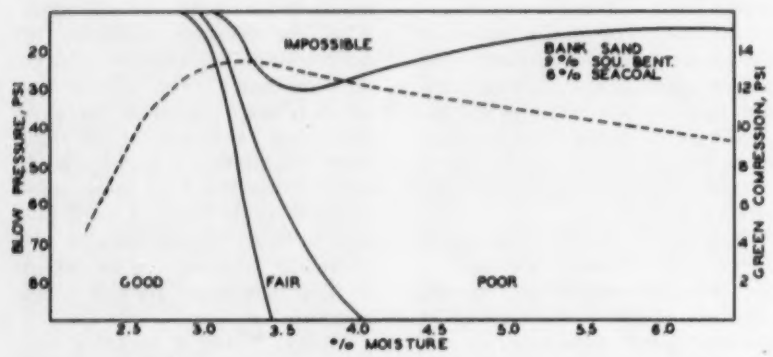
The first comparisons were of a sand bonded with various amounts of clay. The effect on blowability of 6, 8, and 9 per cent southern bentonite on washed and dried bank sand is shown in Figs. 4, 5, and 6 respectively. It may be seen that with increasing clay content the areas of poorer blowability increase and that a wider range of moisture lies in the poorer zones. Also, the pressures necessary for good blowability increase with increasing bond. The dotted line on each chart represents the moisture-green compression strength curve. Notice that it does not necessarily follow that high compression strength alone makes a sand difficult to blow. Higher strength at a particular moisture is more difficult to blow than lower strength at that moisture.

Figures 7 and 8 compare mixtures of lake sand bonded with equal amounts of southern bentonite which were mulled for different lengths of time. Longer mulling produces a chart with larger areas of poor blowability. Excessively long mulling of one batch of sand produced a high green strength sand (19.5 psi) which blew rather well; but in this case, moisture had dropped to 2.2 per cent. Again it is emphasized that a single property cannot be used to judge probable blowability.

Figures 7, 9, and 10 compare the blowability of the same sand-clay mixture but which was blown through different blow plates. In addition to the standard six-hole







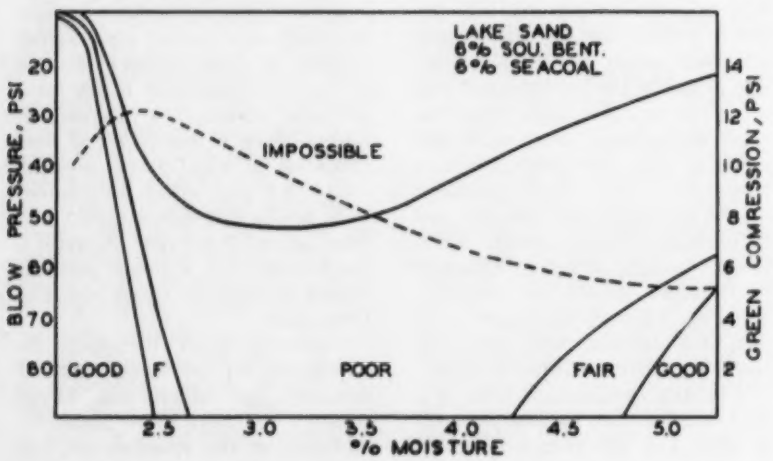


Table 1 . . Sand Grain Distribution of Blowability Mixes

Retained on	Lake Sand	Bank Sand
20 Mesh	0.2	0.0
30 "	0.5	0.0
40 "	3.4	0.0
50 "	22.4	0.1
70 "	46.8	1.6
100 "	25.8	30.0
140 "	0.6	33.1
200 "	0.2	21.7
270 "	0.1	10.0
Pan	0.0	3.5

Fig. 4 (top) . . Blowability of sand-bentonite-seacoal mixture. Dotted line in all graphs is green compression-moisture curve.

Fig. 5 (left) . . Range of blowability reduced due to higher strength.

Fig. 6 (below) . . Blowability similar to Fig. 4 with 1 per cent more bond.

Fig. 7 (bottom) . . Poor blowability at optimum moisture for molding.

plate, a plate with 46 3/8-in. holes and another with one 1/2-in. hole were used. The most significant effect of the 46-hole plate was to pack in the magazine without introducing sand to the mold. Sands which did blow produced molds with an average hardness of only 20 (at 90 psi blow pressure) compared to a hardness of 50 using the standard plate. The effect of the single hole plate was to cause severe channeling in the magazine at nearly every moisture level and pressure.

A complete understanding of the mechanics of blowing would be a valuable aid when determining factors which affect sand blowability. Air pressure over sand in the magazine cannot be thought of as a rammer which pushes sand through the blow holes ahead of it, because a rammer causes the sand to pack and little or none is introduced into the mold. Therefore, sand must be carried through the blow holes by a current of high velocity air, and sand must feed from the magazine until the mold is filled. Velocity of air through the blow holes may be increased by increasing blow pressure, by increasing the size of air lines or using surge tanks, or by decreasing the number or size of existing blow holes. The experiment with various blow plates indicates that too many blow holes with a given volume of air decreases the

velocity through each of the holes to the point where no sand is carried. Although a single hole increased the air velocity, channeling in the magazine was promoted which prevented the mold from being filled.

To find out how sand fed from the magazine, a blowable sand was dyed, one-half red and the other half green. The bottom half of the cartridge was filled with red sand; the top half was filled with green. The first blow produced a completely red mold. More green sand was added to the cartridge and a second blow produced a predominantly red mold with spots of green below the blow holes. A cross section of the mold showed a bell-shaped section of green opposite each of the blow holes showing that green sand fed the last of the mold to be filled. A third blow produced a green mold with only flecks of red. This experiment shows that a blowable sand moves through the cartridge with little mixing from top to bottom.

Blowability of molding sand has been developed largely with respect to moving sand through the blow magazine. It necessarily follows that the quality of production molds should improve as combinations of variables are found which permit a sand to be blown over the ranges of moisture and green strength which are encountered in production. Variables of bond, mulling time, and blow hole area each affect the ability of a molding sand to blow. Effects of changing one or more of these variables can be shown in a qualitative manner on blowability charts.

It is concluded that the most readily blowable sand in one with minimum bond strength. If good blowability is not obtained, it can be improved by increasing blow pressure, by increasing the size of air lines, or by changing the number, location, or size of blow holes. Experience with a production blow-squeeze molding machine substantiates laboratory experience.

In addition to expanding upon variables already mentioned, additional work on blowability will necessarily include considerations of shape of sand grain, sand fineness, type of clay, shape of blow holes, and magazine design.

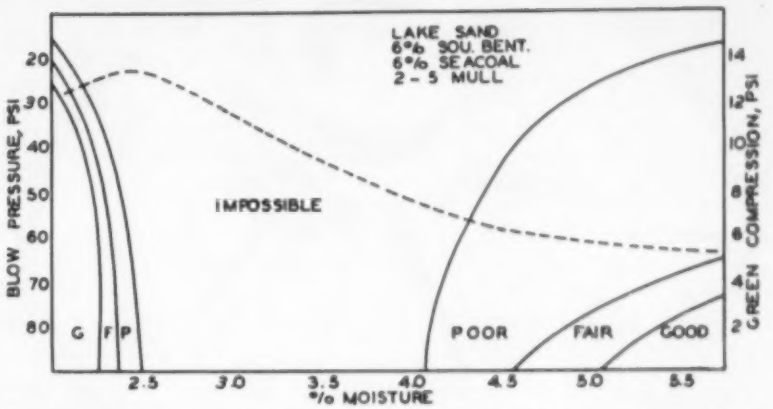


Fig. 8 . . Larger areas of bad blowability produced by excessive mulling.

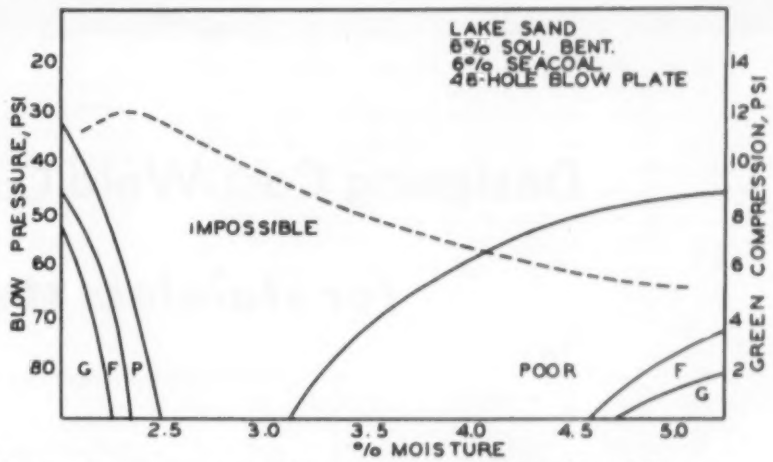


Fig. 9 . . Excessive number of blow holes doesn't improve blowability.

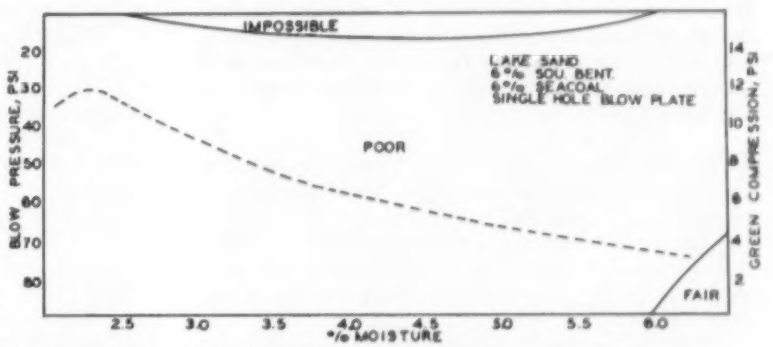
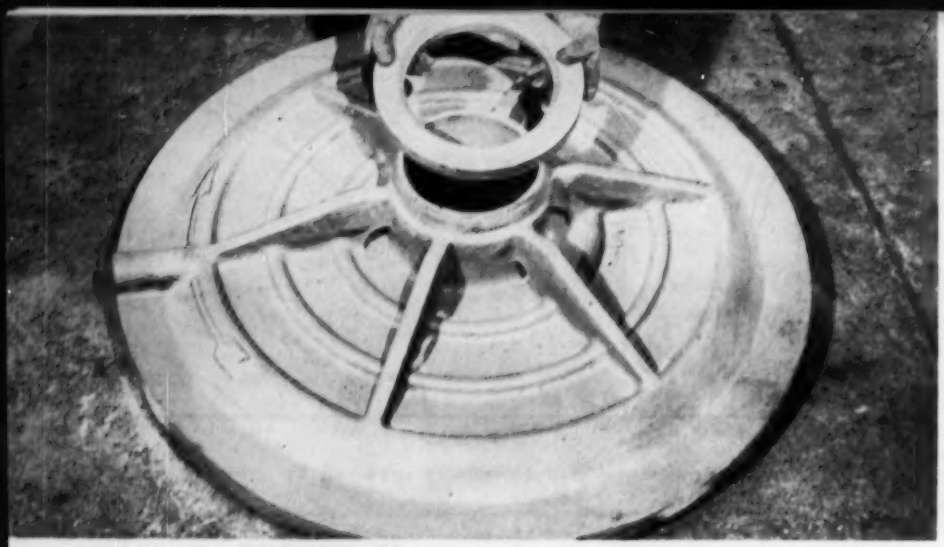


Fig. 10 . . Single blow hole gives predominantly poor blowability.

Table 2 . . Typical Molding Sand Blowability Data

Standard Test 3-ram Specimen	Blow Pressures, psi[1] 90	80	70	60	50	40	30	20	10
Moist 6.5	62, 64	59, 66	63, 70	57, 68	55, 60	Blow	Blow	Blow	No
Perm 14	68, 66	69, 69	73, 72	65, 65	66, 65	Out	Out	Out	Blow
MH 81	64, 70	66, 70	69, 72	63, 63	63, 61				
Def 0.027	64 avg	67 avg	70 avg	64 avg	62 avg				
Comp 6.8	G	F	F	F	F	P	P	P	I
Flow 84									

1. Blown through standard bow plate. Six numbers under each blow pressure are hardness readings; seventh is average; letter denotes blowability: G-good, F-fair, P-poor, I-impossible.



Cast-weld construction calls for a flange to be welded on the large ribbed disc. This method saves a large core and eliminates a feeding problem which the flange would create.

Designing Cast-Weld Construction

for stainless steel

G. L. GIBSON/*Project Engineer*

When components won't yield to standard casting design methods, break them down into several parts and weld them together. The author told how at a Copper Alloy Corp. (Hillside, N. J.) Design Engineers Conference.

■ Welding can be used in two ways. One requires foresight and one hindsight. The hindsight method takes care of all overlooked and forgotten factors and consists of repair welding. The foresight use of welding consists of splitting up complicated castings into sections that can be cast soundly and then welding the sections together.

The fabrication of weldments from steel shapes and the growth of welding have been so closely associated with wrought steel that engineers and designers tend to feel that castings are not weldable. For this reason many fabricated wrought products are designed with sections having a multiplicity of welded details. A much neater and better product could be made by using a casting for the complicated section, and joining it into the assembly by welding. There is therefore a need for a more complete understanding of the weldability of castings to take full advantage of cast weld construction.

Welding and casting are very closely related. When you examine the nature of welding—what is it but a continuous casting? Metal is melted by an electric arc or gas flame and is poured into a metal mold consisting of a beveled joint. The principal difference is that a weld is purposely fused with the mold while in a casting the metal solidifies against the mold. The steel casting industry was probably the biggest single factor in the development of welding, for foundrymen have often been confronted with a few imperfections in an otherwise perfect casting. In fact, the development of fusion welding arose from the need for the homogenous repair of steel castings.

Before 1900 the nearest approach to what could be called a weld repair consisted of drilling out the defect and continuing on through the casting. A plug was arranged on the lower end of the hole and a pouring gate was molded around the top. Hot metal was poured through the hole until the sides of the hole were heated to the fusion temperature at which time the bottom of the hole was plugged and the pouring stopped.

The first use of arc and gas welding for casting repair was just after the turn of the century. One of the very first arc welding machines that the General Electric Co. made was installed in a steel foundry in 1904. However, the quality of the early welding would never meet present-day standards. The welding wire was cut from the nearest fence and was used bare. Coated electrodes did not become common until the late 20's and until their advent, gas welding was used extensively for casting repair. Gas welding gave a weld superior

in quality to bare-wire arc welding but it has never been very satisfactory for welding stainless because of the refractory nature of the chromium oxides. The first important application of the use of welding for joining was during World War I. Welding was brought in as an emergency measure in the shipbuilding program. The alloy casting industry has also found use for the most recent fusion welding processes—the inert gas shield arc welding methods. The tungsten-arc process is used principally for repair while the consumable electrode method is used for automatic welding in cast-weld construction.

Welding repair is still an important factor in any steel foundry, and it is interesting to note that the quality of modern welding is such that defects can be repaired which will pass the most stringent x-ray, magnetic and fluorescent penetrant testing requirements. In spite of this, there is still reluctance on the part of design engineers to use welding for joining castings together or to other wrought materials.

The field of application of cast-weld construction touches only a small portion of the total production of high-alloy steel castings. More cast-weld construction could be used to advantage but the field is generally limited to large or complicated sections. The application of cast-weld construction poses three important questions: When to weld? Where to weld? How to weld?

When to Weld. The process of making castings in sections and welding them together should be considered:

When the designer has followed all the rules and has eliminated as many of the undesirable features as possible, when the molder has used up all the available space with chills, gates and risers and there are still unfed hot spots in the casting, weld them together.

When large awkward coring can be eliminated or substantially reduced.

When long relatively slender castings are required, welding can often be used to an advantage in joining several cast sections together. Savings are sometimes made in using the same pattern for duplicate sections, shorter flasks are required, and dimensions and straightness are under better control.

When comparatively thin sections of large areas are involved, a rolled plate section can be incorporated in the casting by welding; and the center-line shrinkage, to which such castings are subject, can be avoided.

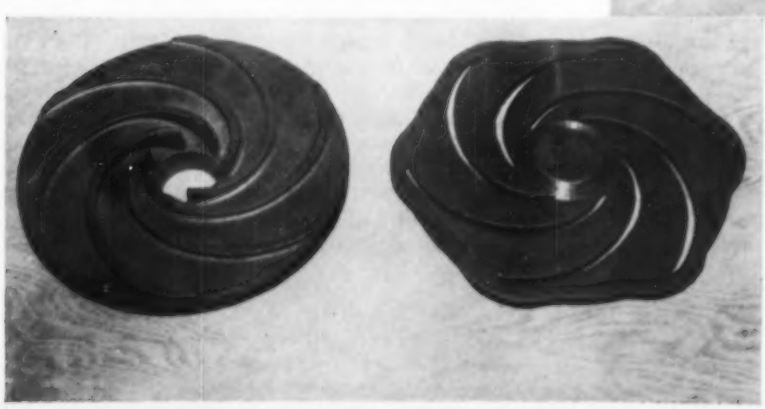
When there are details in the nature of attachments which would complicate the molding of the main section of the casting or the drawing of a pattern, it is simpler to attach them later by welding.

It is not practical to list all the possible applications of where cast-weld construction can be used economically. The important thing is to keep joining by welding in mind as a possible solution of the problems encountered in the design of castings.

It is not always necessary for the original designer to recognize the advantages and specify cast-weld construction. Foundry personnel are often more aware of the quality and cost advantages and recommend changes in the original design. For this reason design engineers do well to maintain the closest possible association with the foundry.

Where to Locate the Weld. The first consideration in locating the weld is to satisfy the objective of welding for quality, coring, size, etc. It is at this point that consideration should be given to the problem inherent with welding. If there is any choice in locating the joint it should be where the welding will be at a minimum. The cost of stainless steel weld metal in place will average about $7 per pound. This high cost of weld metal also imposes an economic limit on how far it is practical to go with weld repair. The type of joint and size of weld must be adequate from a stress standpoint but it is not economical or practical to make all welding joints look like part of the casting. The grinding of welds for appearance is seldom practiced in the fabrication of weldments from wrought materials, and there are few other reasons for structural welds to be ground in castings, yet this expensive practice persists.

The accessibility for welding and the fitting of the parts must also be considered in the location of the joint. A welder must be able to see the point of welding and at the same time be able to touch the bottom of the joint with his electrode angled not more than 45° from the axis of the joint. The fitting of rough castings for welding is complicated by rough casting tolerances and allowances left for machining. If there is a large duplication of pieces, a fixture should be worked out so that the parts are located without measuring for assembly for tack welding. Some casting parts



Narrow, closed impeller for a centrifugal pump (above) is a weld assembly of vaned casting and its cover (left).

are naturally self-aligning and the designer should incorporate such features if possible. A good example of a self-aligning joint is a socket-type pipe joint. Some types of castings, particularly pressure types, require machining before welding in which case the fitting problem is easier. In any case, the drawing of the parts should show all the information required for fitting as well as the exact size and design of the joint.

How to Weld. There is only one minor difference between the weldability of castings and wrought material of the same analysis and that is the effect due to grain size. Austentic and ferritic alloy steel castings have a large grain structure which is not refinable by heat treatment. This large grain structure in certain hot-short alloys makes them more susceptible to cracking during welding than the fine grain wrought product. They can be welded but it is necessary to take greater

Complex coreing avoided by welding-in center pieces.

precautions and use a restricted welding procedure. However the weldability of the common stainless alloys is not measurably affected by grain size.

A designer must be concerned with the details of the welded joint. Fillet welds are the simplest type. These are used to connect two members which intersect at right angles such as stiffeners and other attachments. Fillet welds require no special edge preparation but their size is important. The quantity of weld metal increases as the square of the fillet size, while the strength of a fillet weld is based on its throat section.

Most cast-weld construction results in a butt-type joint. The two members may be in line or at right angles to each other. Butt joints of two equal thicknesses should have complete penetration and welded from both sides if possible. Butt welds of pressure castings, i.e., those containing a liquid or gas, can usually be welded only from the outside but there are special means of getting complete penetration. Some members are completely surrounded by the corrosive media but they are readily welded all around so that there are no pockets for concentration cell corrosion.

Bevel groove joints are most commonly used for butt welding. The maximum practical depth of groove that is beveled from only one side is ¾ in. because over this thickness beveled joints require excessive weld metal and become uneconomical. When thicker material is encountered the joint should be beveled from both sides. When a heavy flange is to be attached to a thinner section, the flange should be beveled only to a depth equal to the thinner section. However, allowance must be made for the amount of metal removed by machining so that there is sufficient weld left for stress requirements. The bevels on castings may be cast or machined but machining is an additional operation and is usually undesirable. A joint that is beveled from both edges should have a 60° groove, but when only one edge is beveled a 45° bevel is preferable.

It is important for a designer to take advantage of all the new tools and methods used in foundries. One such new process consists of carbon-arc cutting in a blast of air. These torches normally are used to cut out defects in castings but they also are used particularly in fabricating shops to prepare grooves for butt welding. The method consists of butting up unprepared ends of members and tack welding them together. One side of the joint is cut out in the form of a U-groove which is generally the most desirable shape for butt welding. After one side is welded, the opposite side of the joint is grooved down to sound weld metal and then welded. The carbon-arc air blast cutting operation is clean and results in very little heating of the casting. All the melted metal is continuously blown away so there is no danger of contamination with carbon. If there are any defects in the casting which might interfere with welding they will show up and can be removed while cutting. With this method of groove preparation the designer simply has to specify the depth of the weld.

The metal-arc process with coated electrodes is the method used for welding stainless. Electrode manufacturers now offer 20 different alloy electrodes for chromium-nickel austenitic stainless steels and five alloys for straight chromium steels. These electrodes are designed to match chemically the standard grades of stainless. Metal-arc welding is the most versatile method and the quality of the welds is equal to that of the base material. However, metal-arc welding is not suitable for automatic welding. When more than ten castings are involved and more than five pounds of weld per casting is required, automatic or semi-automatic welding should be considered. The automatic welding method most suitable for welding stainless steel castings is an inert-gas-arc process.

Automatic weld metal deposition rate is two to four times that of manual arc welding and has the advantage of continuous deposition so that the labor costs are considerably reduced. On the other hand, motorized welding positioners or special welding jigs are usually required, so that considerable production is required to make automatic welding worthwhile.

In welding austenitic stainless steels for corrosion resisting application consideration must be given the phenomenon of intergranular corrosion. Except for the ELC grades and those stabilized with columbium or titanium, all weldments must be solution heat treated. This consists of water-quenching from about 2000 F—the exact temperature depends on the alloy. This operation is difficult for large sections and it can result in distortion. Stabilized or ELC grades of stainless steel should be used in large cast-weld construction.

D. I. SINIZER / *Project Manager, Metallurgical Dept., National Research Corp. Cambridge, Mass.*

C. M. ADAMS, JR. / *Asst. Professor of Metallurgy, Massachusetts Institute of Technology, Cambridge*

Titanium Casting

Metallurgy and Production Techniques

High quality titanium castings have been made with pilot plant equipment... Furnaces are available for commercial 50-lb heats.

■ After extracting titanium from its ore, one of the major concerns of the titanium metallurgist is to keep the metal from becoming an alloy of titanium with carbon, nitrogen, oxygen, or hydrogen. He must also keep it free from contamination by commonly used refractories with which titanium reacts readily. Since titanium and its alloys can rapidly lose their utility by such contamination the metallurgy of titanium is restricted to atmospheres and equipment which will keep the metal pure.

In producing commercial ingots of titanium and its alloys for subsequent reduction to fabricated forms, consumable electrode melting is most often employed. A briquetted-sponge titanium bar becomes one electrode of an electric arc, a water-cooled copper mold is the second electrode. The electric arc between these two electrodes melts the sponge bar into a pool of molten metal on top of the partially solidified ingot. The ingot solidifies progressively and either the ingot or the consumable electrode is retracted as the ingot solidifies while new sponge is fed into the arc. Melting proceeds in this fashion until the desired ingot length is produced. Melting is carried on in a partial vacuum or in an inert atmosphere and liquid titanium is always in contact with a shell of solid titanium. Only a relatively small quantity of metal is molten at any given time.

Shape casting titanium and its alloys requires the same rigid control of atmosphere and equipment. It is

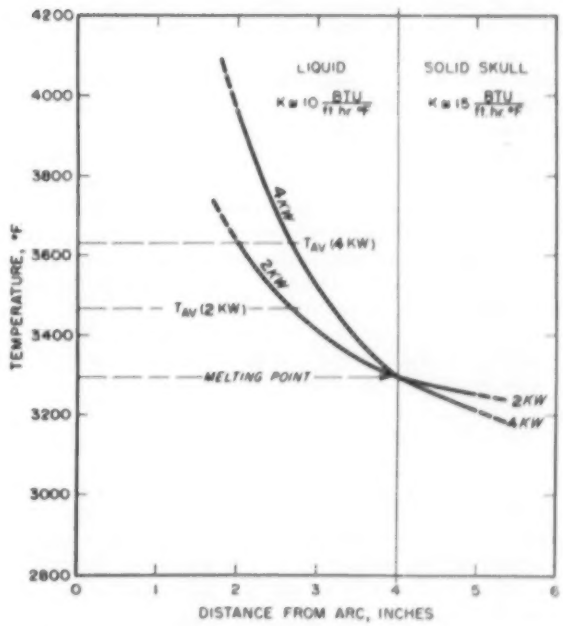


Fig. 1 . . Thermal features of skull melting when pool is formed and heat flow approaches a steady state.

further complicated by the necessity for maintaining a liquid bath large enough to fill the desired mold cavity and by the insane desire of the cast metal to react with the mold material. A solution of these problems has resulted in a commercially feasible process for shape casting titanium and its alloys.

Split-mold castings in specially prepared molds have been made with good surface finish, a minimum of surface contamination, a high degree of soundness, and good physical properties. Investment castings have been made with excellent definition and precision using modifications of standard techniques. The molding process is covered by U. S. patent applications.

There have been many descriptions in recent technical literature of apparatus, procedures, and ideas for handling and casting titanium and other so-called rare or refractory metals. At first glance the field appears to be full of pure gadgetry since attention is invariably focussed upon equipment details rather than underlying principles, and differences between the techniques of various investigators are emphasized, rather than similarities. Consequently, before launching into descriptions of yet another apparatus, the following paragraphs are a summary of the essential problems involved in casting titanium directly into useful shapes without contamination by carbon, oxygen, nitrogen, or hydrogen. All of the melting furnaces and molding procedures which have been described, and successfully used, have several features in common, since the metal itself dictates a fairly rigid set of rules.

Handling Liquid Titanium. The outstanding characteristic of liquid titanium is, of course, its chemical reactivity. Protracted contact with any known nonmetallic refractory will result in contamination, and the only suitable melting atmosphere is an inert gas, or vacuum. Regardless of crucible material, thermal conditions are adjusted so that the crucible is "lined" with solid titanium by using a localized source of heat above the crucible and encouraging heat loss through the crucible walls, thus maintaining a pool of liquid metal in a solid skull. To date, the only reasonable heat source which can be localized in this way and which is operative above 3000 F is an electric arc.

The reactivity of titanium also seriously hampers the molding procedure. To employ nonmetallic refractory molding materials successfully, the metal must freeze and cool fairly rapidly to avoid harmful surface contamination. The solidification time for a section of a casting must not exceed a certain critical value if contamination or mold breakdown is to be avoided. This critical value depends solely upon the stability of the refractory and the length of time the mold-metal interface is at high temperature. Therefore, very heavy sections can only be cast in metal or water-cooled molds to avoid contamination during their increased period of solidification.

The use of heated or insulated molds is definitely limited because they increase solidification time and, therefore, the possibility of surface contamination. Molds may be heated slightly to improve fluidity if the casting section is thin, and the refractory is relatively stable (does not easily give up its oxygen).

Refining and Remelting. The possibilities of developing techniques for removal of carbon, oxygen, nitrogen, and hydrogen from the melt have not been fully investigated. A very high vacuum, maintained over a bath of molten titanium for some time could, in principle, remove all four elements (carbon would evolve as monoxide). The chief practical difficulty lies in maintaining an efficient arc with a permanent electrode in a high vacuum. Even the elaborate zone-melting technique would be foredoomed to failure since nitrogen and oxygen would tend to segregate in a direction opposite to that of carbon and hydrogen.

Fig. 2 . . Typical gating of investment cast test bars.

In the absence of melt refining, the amount of returned scrap which can be tolerated in the charge is limited by the purity of the sponge, contamination (if any) to be expected during melting, and the quality of the scrap. Gates and risers which have reacted excessively with the mold must be conditioned before melting. Since it has been found possible to avoid measurable contamination during melting, the outlook for remelting scrap is bright.

Thermal Features of Skull Melting. Skull melting imposes some drastic limitations on the control of pouring rate and liquid metal temperature. Consider the thermal picture as it exists after a pool of liquid metal has been formed in the crucible and heat flow has stabilized, more or less, a steady state (Fig. 1). The metal is roughly in the form of a hemisphere, flat side up, with the heat source near the center of the flat surface. The outside of the hemisphere is solid; heat flows from the source through the liquid and solid titanium into the crucible. Little melting takes place because heat loss

nearly equals heat input at this stage. There is a continuous temperature gradient from the hottest region (near the arc) to the crucible. The interface between liquid and solid titanium is, of course, at the melting point. The bulk of the liquid is above the melting point and, although the temperature is nonuniform, it is convenient for casting purposes to think in terms of an average liquid temperature. The only way in which this average temperature may be raised is to increase the flow of heat through the system, thereby increasing the temperature gradient in the liquid. The rate of heat removal from the crucible must also be increased to balance the higher power input and maintain the skull.

Figure 1 shows idealized temperature distributions calculated for two power inputs. These distributions are calculated assuming spherically symmetrical, steady heat flow from a localized central source, through the bath and into the skull. Temperature, T, as a function of the distance, r, from the center of the heat source is calculated from Equation 1:

$$T - T_m = \frac{3.41\ P\ (R_m - r)}{2\pi\ K\ r\ R_m}$$

where: K = thermal conductivity, Btu ft/hr F
P = power transmitted through the liquid, watts
$3.41\ P$ = power transmitted through the liquid, Btu/hr
R_m = radius of liquid zone, ft
T_m = melting point, F

The average temperature, T_{av}, (based on total liquid heat content) is calculated from Equation 2:

$$T_{av} = \frac{3.41\ P}{4\pi\ K\ R_m} + T_m$$

The values, 4 and 2 kw, refer to that fraction of the total power which actually finds its way into the metal, and through the skull. The total power requirement to maintain liquid bath of this magnitude is, of course, much larger because of radiant heat losses from the arc and the metal. Average liquid temperatures for the two levels of power input are also shown in Fig. 1. Figure 1 is intended to illustrate principles rather than magnitudes; it should be noted, for example, that the shape of the liquid zone in skull melting is shallower and wider than a hemisphere. The magnitudes indicated in Fig. 1 pertain to conditions in a small single electrode arc-melting unit.

Equation 2 shows superheat is roughly proportional to power input and inversely proportional to thermal conductivity. The melting process is definitely benefited by the low thermal conductivity of titanium. It is interesting that, for a given power input, superheat is inversely proportional to the size of the bath; however, a large bath retains superheat longer when power is interrupted for pouring.

The superheat present in the liquid metal, as poured from the skull, is quite low then for two reasons: The amount of heat which can be pumped through the system is limited, and steep temperature gradients are rapidly dissipated when the power is turned off before pouring; the liquid tends to approach a condition of equilibrium with the skull, which means superheat is lost unless pouring is done quickly.

Gating. The preceding paragraphs have described conditions which impose limitations on the casting of titanium. The principal problem is one of casting relatively cold metal into a relatively cold mold. It has been found necessary to pour very rapidly through large gates. Solidification appears to be quite rapid and good surface detail is difficult to achieve. There is a marked tendency to entrap inert gas (which is present to support the arc) so that overflows are frequently used to reduce turbulence in the mold cavity. Oversize gates in conjunction with overflows and conventional risers can reduce yields below 50 per cent. A typical setup of gates for investment casting six tensile bars is shown in Fig. 2.

Solidification of Titanium Alloys. The lone cheerful aspect of the situation is the favorable mode of solidification of titanium alloys. The combination of high melting point and low thermal conductivity leads to steep thermal gradients during solidification. Consequently, there is little tendency toward "mushy" or dendritic solidification; finely dispersed microporosity is absent from cast titanium. Porosity, if present in a casting, is coarse enough to be easily detected by radiography. Furthermore, since titanium forms a strong skin almost immediately upon contact with the mold as a consequence of steep gradients, cored blind risers may be used with good success. Risering requirements, shrinkage, and general solidification characteristics of titanium closely parallel those of steel rather than those of aluminum, copper, and magnesium base alloys.

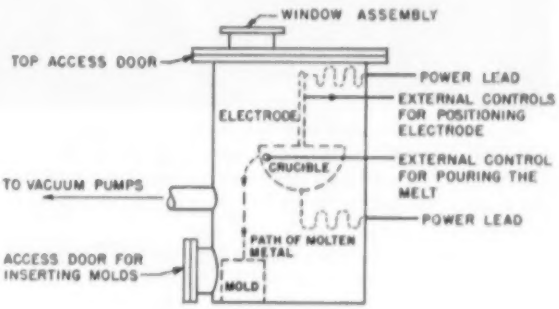


Fig. 3 . . Diagram of a simple titanium casting furnace.

Titanium Furnace. Figure 3 is a schematic diagram of a simple titanium casting furnace. The outer shell is a vacuum-tight chamber which may or may not be externally cooled depending upon the design of the furnace. Molds and metal charge are inserted through the front and top access doors and the chamber evacuated to the desired vacuum with conventional oil diffusion and mechanical pumps. An inert atmosphere, such as argon or helium, may be introduced before melting is begun.

Melting is begun by lowering the tungsten-tipped electrode until it touches the titanium sponge and strikes the arc. The molten bath is contained in a shell or skull or solid titanium inside a graphite crucible. When a bath of sufficient size has been melted, power is shut off and the metal poured by tilting the skull and

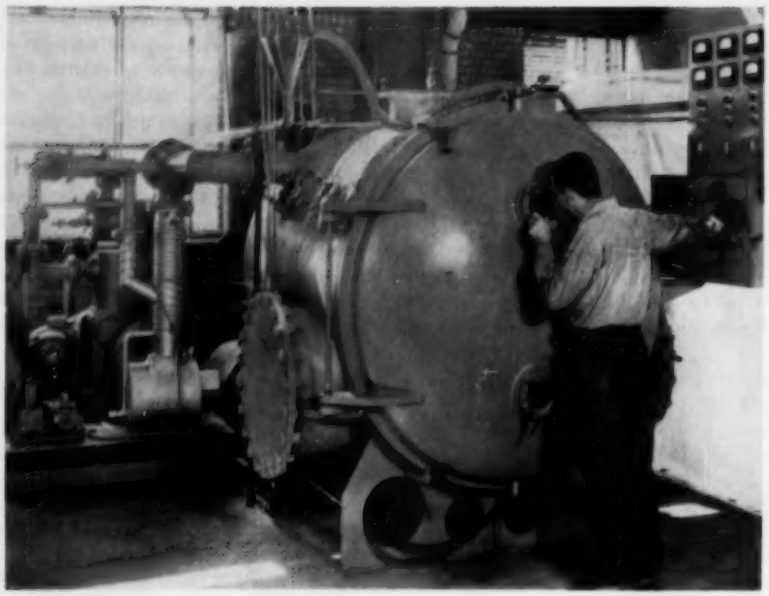


Fig. 4 (left) . . Commercially-available furnace for melting up to 50-lb heats of titanium has a water jacked chamber enclosing the melting unit. After evacuation the chamber is filled with argon to a pressure of about 200 mm of mercury before melting is begun.

Fig. 5 (below) . . Furnace with three electrodes, graphite crucible lined into stainless steel shell, and water-cooled copper cover lined with molybdenum radiation shields is tilted to pour positioned mold by external operated tilting mechanism.

crucible through externally operated controls. The chamber is opened and the castings are removed when they have cooled sufficiently to prevent atmospheric contamination.

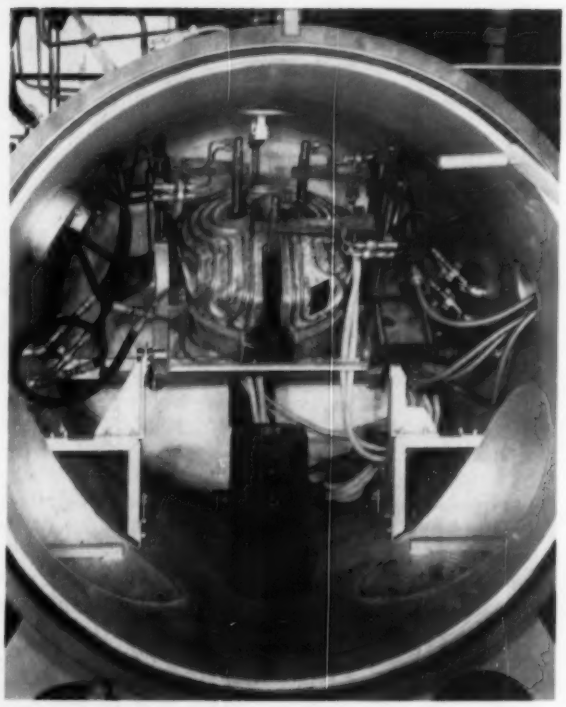
A commercially-available furnace for melting up to 50 lb of pure titanium or its alloys is shown in Fig. 4 and 5. In this furnace the skull is set in a graphite crucible backed by ramming mix in a stainless steel shell. A water-cooled copper cover lined with molybdenum radiation shields prevents excessive radiation losses and increases the efficiency of power use. A molten bath about 12 in. in diam. and 2 to 3 in. deep can be maintained. No molten titanium comes in contact with the graphite crucible and recent castings have contained less than 0.06 per cent carbon, about the same as the starting raw material, titanium sponge.

Furnace Specifications

Power is fed through three electrodes of negative polarity, each powered by a 900 amp DC welding generator; the molten bath is the positive electrode. A panel board with indicating meters and furnace controls for positioning electrodes is attached to the furnace. Each electrode draws about 900 to 1000 amp at 25 to 30 v. Approximately 1 kw-hr is consumed per pound of metal melted.

The chamber enclosing the skull, crucible, and electrodes is a water-jacketed shell approximately 5 ft in diam. and 5 ft long. Power and cooling water are fed through vacuum-tight fittings on the shell. Tilting mechanism and electrode-positioning devices are operated externally; motion is transmitted through O-ring seals in the shell. A pressure of two microns or less can be maintained within this shell. Cold leak rate is less than one to two microns per min. After evacuation the chamber is back-filled with argon to a pressure of about 200 mm of mercury before melting is begun.

Molds. Patterns for split-mold castings are made by conventional techniques using a shrinkage factor of about $\frac{1}{8}$ in. per ft. Conventional wax or plastic patterns are used for investment castings.



A special refractory slurry is poured over split-mold patterns, allowed to harden, then fired to make a strong coherent pattern. Investment molds are prepared by dipping the wax patterns into a special precoating slurry. The precoat is allowed to solidify and is backed with standard investments in metal flasks.

Molds are given special treatment during fabrication to permit them to withstand the action of molten titanium. Molds are assembled with the necessary gates, risers, and pour blocks and held together with appropriate clamps or jigs. Investment molds are dewaxed and fired in standard fashion before use.

Surface Contamination Surface contamination of castings by mold reaction seriously impairs the ductility of titanium castings. The extent of surface contamination of castings by reaction with molds has been evaluated by making microhardness traverses perpendicular to the surface. Since the hardness of titanium and its alloys is appreciably affected by total carbon, nitrogen, and oxygen content in a predictable fashion, hardness traverses represent an extremely sensitive indication of interstitial element pickup during solidification. Typical traverses shown in Fig. 6, are from data obtained by Dow Chemical Co. at Midland, Mich.

Transverse Hardnesses

Typical hardness curves for castings made in unprotected molds reveal a drastic hardness increase at the casting surface. Hardness decreases gradually at greater depths below the surface until it reaches a low level equal to the hardness of uncontaminated metal at a depth of 0.050-0.060 in. below the surface. This is roughly the limit of penetration of contaminants for sections up to 1 in. in unprotected refractory molds.

Similar hardness traverses have been made on castings poured into protected molds. In these hardness traverses the increase in hardness at the surface is very much less and hardness decreases to the hardness of uncontaminated metal at a depth of 0.004-0.006 in. below the surface. This is clear proof that protected molds provide freedom from surface contamination.

Physical Properties of Titanium and Alloy Castings. Typical physical properties of pure titanium castings poured from a skull furnace are given in Table 1. These properties were determined from investment cast tensile bars similar to those shown in Fig. 2 or from tensile bars machined from a 2 in. square cross-section chill-cast ingot. The increase tensile strength of annealed test bars from chill-cast ingots is, as yet, unexplained.

A typical chemical analysis for the cast tensile bars is also shown in Table 1. Carbon content is significantly lower in recent castings than was previously possible. Modifications in melting and casting techniques make possible production of castings having essentially the same interstitial content as the titanium sponge raw material.

Physical properties obtained at Watertown Arsenal for 4 per cent Cr-2 per cent Mo alloy titanium castings are shown in Table 2. These properties were determined on bars cut from castings supplied to Watertown Arsenal for evaluation.

Other alloys of titanium have also been cast using the skull melting technique. Among these are a 4 per cent Al-4 per cent Mn alloy, 2 per cent Al alloy, 4 per cent Al alloy and others. All have been made with high strength and good ductility. Interstitial pickup has been reduced to a minimum, yielding sound castings with good physical properties.

Conclusions. Metallurgical requirements for the casting of titanium have been evaluated and production equipment and techniques evolved for the commercial casting of titanium and its alloys. High quality castings have been made in pilot plant equipment. Furnaces are now available for pouring melts up to about 50 lb in a commercially feasible operation.

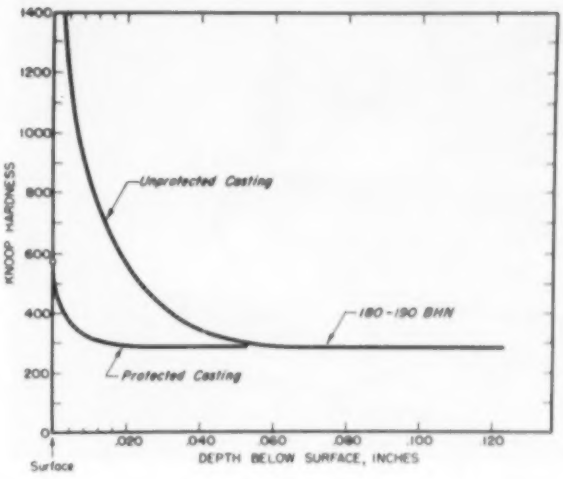


Fig. 6 . . Typical traverses show surface contamination.

Table 1 . . Properties of Pure Titanium Castings
(Carbon,—0.018%; oxygen,—0.135; hydrogen,—0.013; nitrogen,—0.006)

Chill Cast Ingots	*As-Cast*		*Annealed**	
Ultimate Tensile Strength (psi)	67,800	67,700	86,500	85,500
Elongation in 1.4 in. (%)	17.4	18.6	18.0	13.9
Reduction in Area (%)	25	27	14	10
Hardness (R_A)	50.5	49	50	49
Cast Tensile Bars				
Ultimate Tensile Strength (psi)	76,000	73,300	76,300	74,900
Elongation in 1.4 in. (%)	8.8	12.0	10.4	13.6
Reduction in Area (%)	17	11	16	12
Hardress (R_A)	—	51	50.5	49

*Annealed 1 hr in argon atmosphere at 1350F.

Table 2 . . Properties of a 4% Cr-2% Mo Alloy of Titanium

Cstg.	Hardness	Yield psi 0.1% offset	Tensile psi.	Elong. %	R.A. %	V-Notch Charpy ft. lbs. +23°C	V-Notch Charpy ft. lbs. −40°C
1	26	100,000	124,500	7.9	12.4	7.8	6.0
2	27.5	102,000	125,500	6.4	7.6	4.0	3.5
3	28	105,000	128,000	17.1	32.6	30.3	19.0
4	25.5	97,500	119,000	14.3	26.5	7.0	5.3

Research and development are progressing to advance our knowledge of titanium casting production in quantity. Castings of high strength and good quality can find increased use in the aircraft industry where titanium's high strength-weight ratio and rupture strength in the intermediate temperature range make it a useful structural material. High resistance to attack by many severely corrosive media make titanium castings increasingly important to the chemical process industries.

Acknowledgements. The authors gratefully acknowledge permission to use mechanical properties obtained in the Watertown Arsenal Laboratory, Watertown, Mass., and hardness traverses reported by Dow Chemical Co., Midland, Mich.

Fig. 1 . . Tension test specimens poured every hour, identified by heat and time and annealed with the castings, are held for customer inspection.

Start Duplex Malleable Control with Raw Materials

LAWRENCE E. EMERY / *Chief Metallurgist*
Marion Malleable Iron Works Div.
Chicago Railway Equip. Co., Marion, Ind.

■ Duplexed malleable iron requires close control of the melting process to insure uniformity. Full knowledge of the effects of raw materials on metal castability, annealability, and physical properties is vital to the production of a uniform high-quality product. Because the old time melter was aware of differences in pig iron, he made it a practice to use a mixture of various types of pig to produce a good heat.

Most foundries use malleable pig iron in the duplex melt charge. Due to its graphitic carbon content resulting in increased centers of graphitization, pig iron causes malleable iron to be sensitive to precipitation of primary graphite if silicon is not maintained at a low level. Low silicon levels, however, are prone to shrink and tear, and require longer annealing time.

Graphitic carbon in the charge causes pearlitic malleable to have unusually shaped nodules of erratic size and wire distribution. It affects machinability and physical properties by contributing to primary graphite and more nodules, small and close together.

Figure 2 shows the effect of graphitic carbon-bearing materials in the charge on the relationship of annealing time and the number of graphite nodules. Physical properties were below par consistently, even with normal carbon values. Spectrographic analyses (Table 1) show the charge containing malleable pig to be considerably higher in copper, nickel, and titanium than a charge without malleable pig. Copper and nickel promote precipitation of primary graphite; copper, an especially powerful graphitizer, increases the number of graphitization centers, resulting in smaller, more numerous temper carbon nodules.

Pig iron is affected by its ore as well as blast furnace

Duplex Malleable Control Tips

Purchase all raw materials on specification for better basic, initial control.

Keep graphitic carbon bearing materials under control to improve nodules and physicals.

Use sound cupola practice to lessen loss of silicon and manganese for better annealability.

Determine metal temperature with good pyrometer practice to control castability.

Select proper metallurgical coal for furnace atmosphere control. Make proximate analysis of each car of coal.

Test metal fluidity to indicate melting conditions.

Desulphurize to refine metal, control sulphur, and minimize non-metallic inclusions. Low sulphur irons have increased strength and ductility due to improved nodule shape and distribution.

practice. Many foundrymen and metallurgists refer to this as heredity. In view of this, microstructure and residual alloy content of pig iron should be checked constantly. Iron from a charge in which silvery iron has replaced the variable pig iron does not mottle as easily as iron from a higher graphitic-bearing charge; therefore, it has improved microstructure and increased uniformity. Increasing the silicon content of the base metal reduced annealing time.

Temper carbon shape, size, and distribution are more uniform in both malleable and pearlitic irons from a low graphitic-bearing carbon charge. Physical properties of both irons exceeded the specifications for yield, tensile, and elongation.

Nodule shape, size, and distribution are affected by many factors. The type of nodule shown in Fig. 3 is undesirable because the large number of small temper carbon nodules, being close together, form planes of weakness through the ferrite. This type of structure, however, would have superior machinability due to the short distance between nodules which act as chip breakers.

Equally important in producing good iron is control of the type and quantity of steel in the charge. For ideal cupola melting conditions, steel scrap in a well-balanced charge should be at least ¼-in. in section. Light flashings are particularly difficult to melt as they are prone to oxidize excessivley.

In the author's plant, the steel portion of the charge consists entirely of low phosphorus metal: 12 per cent plate scrap; 44 per cent angle, bar, and rail; and 44 per cent shells or forge crop-ends. The uniform quality of these types of steel scrap is ideal for consistent cupola operation.

If the steel content of the charge is held constant, there is a minimum of variation in annealability. If the steel content is increased, casting hardness is increased and metal structure is changed. High steel mixtures produce iron with less tendency to mottle and with increased physical properties. Iron from mixtures containing more than 40 per cent steel has an abnormal tendency to shrink and tear. It is possible, however, to increase fluidity and decrease tearing by increasing the silicon content of a high-steel melt.

Whereas light steel scrap will cause excessive oxidation in cupola melting, excess air in the air furnace will oxidize the melt and adversely affect castability and annealability. A series of tests were conducted to determine the effects of increased oxidation on first stage graphitization.

Figure 4, nodule count after annealing at 1700 F for various lengths of time, shows that decomposition of carbides was completed sooner in the iron which was melted under ideal conditions. Variations in nodule shape and size were marked, and the number of non-metallic inclusions were greater in the iron melted under more severe oxidizing conditions.

The degree of oxidation was determined by the amount of FeO in the cupola slag and by the increased loss of silicon and carbon from cupola metal. Metal fluidity decreased when FeO content of slag increased and abnormal fractures of the as-cast specimen were noted.

Microspecimens used in the oxidation test were machined from bars 1 in. square by 7 in. long. Bars were

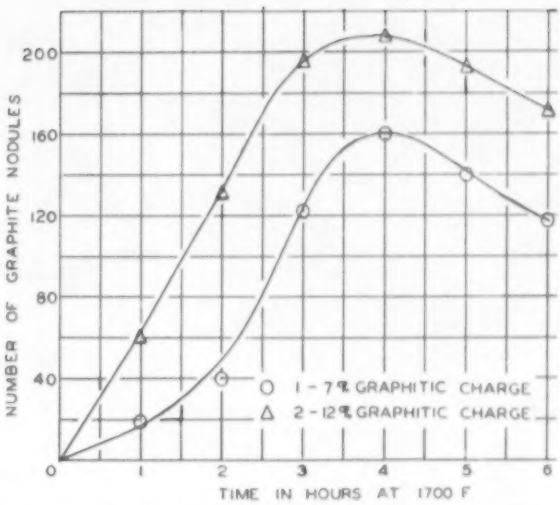


Fig. 2 . . Effect of graphitic bearing charge materials on relationship of annealing time and nodule count.

Table 1 . . Spectrographic Analyses of Malleable Charges

Charge Components	Charge 1 per cent	Charge 2 per cent
Malleable pig	10	none
Malleable scrap	5	4
Silvery pig	none	6
Sprue	47	51.5
Steel scrap	100	100.0
Charge Analyses		
Silicon	1.07	1.35
Manganese	0.53	0.50
Sulphur	0.171	0.130
Carbon	2.51	2.45
Copper	0.16	0.08
Nickel	0.14	0.01
Titanium	0.10	0.02
Boron	0.002	0.0005
Aluminum	0.010	0.006
Phosphorus	0.120	0.030

heated in a furnace for three hours to 1700 F, then removed at increments of one hour and cooled rapidly with forced air. A microspecimen from each bar was polished for nodule examination. Nodules were counted and measured in the center and at both edges of a 6 in. diameter circular field. Due to migration of carbon nodules and non-metallic inclusions, a number of readings were taken to obtain statistical averages shown in Fig. 4. Composition of the iron in this test was C, 2.35 per cent; Si, 1.22; Mn, 0.48; S, 0.150; and Cr, 0.020.

Avoiding the formation of exceptionally large or coarse temper carbon nodules (Fig. 5) is of paramount importance in maintaining physical properties. Properly superheating molten cast iron improves rate of graphitization and structure.

A disappearing-filament-type pyrometer is used to check temperatures because it is dependable and operators are able to read plus or minus 10 degrees. Metal temperature is checked every 30 min at the cupola spout, every 30 min at the air furnace spout, and once an hour at the pouring line. The pyrometer is used also to check air furnace flame temperatures to insure proper super-heating. The pyrometer together with a combustion testing instrument is used in balancing

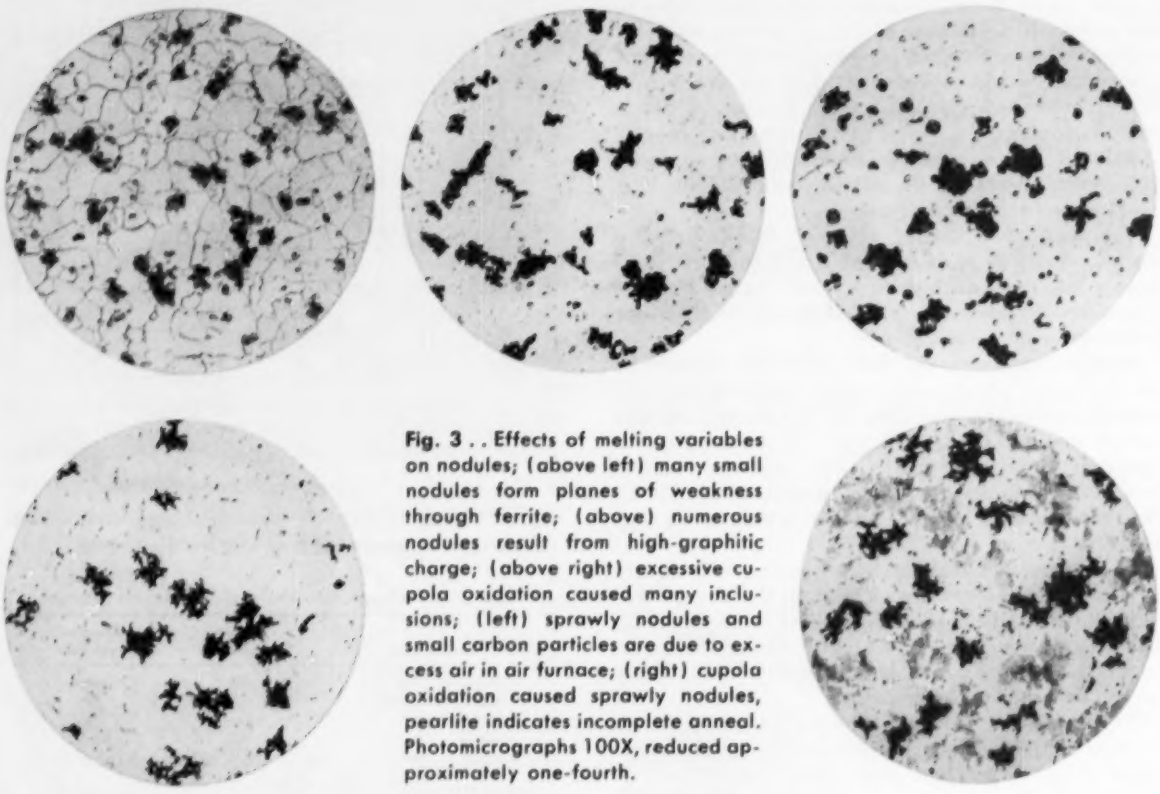


Fig. 3 . . Effects of melting variables on nodules; (above left) many small nodules form planes of weakness through ferrite; (above) numerous nodules result from high-graphitic charge; (above right) excessive cupola oxidation caused many inclusions; (left) sprawly nodules and small carbon particles are due to excess air in air furnace; (right) cupola oxidation caused sprawly nodules, pearlite indicates incomplete anneal. Photomicrographs 100X, reduced approximately one-fourth.

flame temperature between the front and rear of the furnace by altering combustion factors.

Two optical pyrometers are used to determine temperatures; one instrument (kept in the laboratory) is used to check the service instrument. Every three months the service pyrometer is sent to the manufacturer for inspection and repairs and the laboratory instrument becomes the service instrument.

The importance of good pyrometer practice in temperature control cannot be over emphasized as many casting defects can be traced to metal temperature fluctuations. Readings should always be taken in the dark portion of the stream. Due to the higher emissivity of iron oxide film and slag in the bright portion of the stream, temperature readings taken at this point will be higher. Accurate readings cannot be obtained through smoke or dust. It is good practice to take readings at the same location each time temperature is determined.

The old-time foundrymen, who did not have pyrometers, were well aware of the effect of temperature; by trial and error they found that different types of work should be poured at different temperatures. The old adage, hot iron will cover up a multitude of sins, is more the exception than the rule today. The broad effect of superheat on graphitization, shrinkage, and tears makes good pyrometer practice imperative.

Fluidity of cast iron is influenced by many factors; however, under specific conditions, fluidity trends can be established. At Marion Malleable two fluidity spirals poured once an hour show any serious change in metal composition or temperature. Correlating fluidity with misruns is relatively simple and results for a one-year period have been gratifying.

A possibly antique, but practical, method of checking fluidity and metal characteristics is based on the spoon test. This procedure consists of dipping a sample of metal from the bath with a laboratory ladle 3 in. in diam and 2½ in. deep, which has been thoroughly dried, then preheated by immersing in air furnace bath. When the ladle is removed from the furnace a stop watch is started and the operator observes the metal in the ladle through melter's glasses. As soon as the metal begins to break, the watch is stopped. Elapsed time will vary with metal composition, temperature, oxidation loss, and melting and super-heating atmosphere.

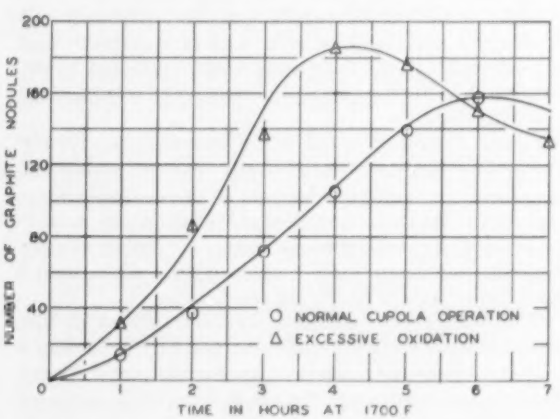


Fig. 4 . . Comparison of excessive oxidation in cupola with normal operation on the relationship of nodule count and annealing time.

The standard for a plant will depend on its particular operation.

Figure 6 is a graph of results of the spoon test on a cold-melt operation. The graph shows that a spoon test time of 50 sec should indicate a carbon range of 2.35-2.45 per cent and a tapping temperature of about 2800 F. This test is valuable for checking the progress of a cold-batch melt. Although this chart would hold true only for this particular cold-melt operation, a similar set of figures could be accumulated and plotted for any operation.

For best results in Marion Malleable's duplexing operation, it was found desirable to have a minimum of 75 sec on the spoon test. If temperature is within the normal range, it is possible to estimate carbon and silicon contents.

The amount of air required for theoretically ideal combustion can be calculated; however, in practice it is difficult to reach theoretical accuracy in air furnace operation. Furnace efficiency and melting and superheating conditions are determined by measuring the amounts of the products of combustion with a "heat prover." On the basis of these tests, and depending on the stage of melting, the air-fuel ratio is adjusted to attain the proper furnace atmosphere. The heat prover periodically draws samples of furnace atmosphere through a water-cooled sampling tube. The instrument measures the amounts of various gases; indicating immediately changes in combustion.

Air-fuel ratio and proper mixing not only govern combustion efficiency and flame uniformity, but they also determine furnace atmosphere which affects physical properties of the metal by influencing nodule shape, size, and distribution. During the superheating and refining period combustion efficiency is usually at its peak with a minimum of CO present. This period with a small excess of oxygen and a trace of combustible is the most satisfactory, economically and metallurgically.

Daily variations in outside atmosphere necessitate adjustments in the air-fuel ratio to maintain consistent furnace operation. Many duplexing foundries have installed moisture control equipment on cupola blast for greater control of melting conditions. Since the air furnace does not have moisture control, fuel requirements and air-fuel ratios become the critical factors.

An atmosphere rich in CO (increased combustible content) produces metal which, when cast and annealed, has a marked reduction in physical properties due to sprawly, lattice-type temper carbon nodules (Fig. 7). Iron thus affected is more sensitive to mottling, even when carbon content is in the lower ranges. Composition of the specimen in Fig. 7 is 2.18 per cent carbon, 1.28 per cent silicon, 0.45 per cent manganese, and 0.16 per cent sulphur.

Figure 8 is a photomicrograph of the as-cast structure of metal in Fig. 7. Figure 9, the as-cast structure of an iron from a furnace with ideal atmosphere, shows a more uniform, much finer structure.

The effect of atmospheres on shrinking and tearing is not to be overlooked. Atmospheres rich in CO promote tearing and micromottling. Figure 10 is a photomicrograph of micromottling in a $\frac{3}{16}$-in. section of a casting that was poured at the end of the heat from a furnace whose atmosphere was rich in CO. Carbon reduction in this operation was only 0.10-0.15 per cent. Composition of this metal was: C, 2.25 per cent; Si, 1.30; Mn, 0.45; and S, 0.130.

Occasionally it becomes necessary to make additions to the bath of metal in the air furnace. The furnace should be plugged before an addition is made, and held for five minutes afterwards. After the addition has been made the bath should be puddled with a green sapling. Moisture escaping the green wood mechanically mixes the addition into the bath.

Large additions of silicon, manganese, or carbon have a tendency to inoculate the bath, promoting the formation of primary graphite. Figure 11 shows primary graphite in malleable iron, the effect of an addition of manganese; the sample was poured within two minutes after the addition was made. After puddling for five minutes, however, the fracture was free from primary graphite.

Susceptibility to inoculation is more pronounced in higher silicon irons and there is a greater danger when the furnace atmosphere is rich in CO. After the cupola

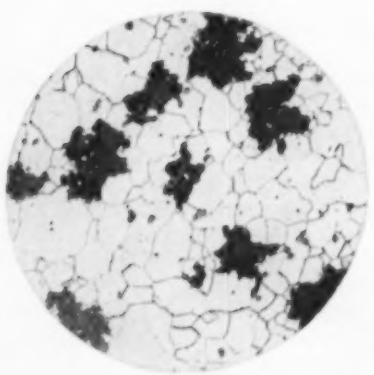


Fig. 5 (above) . . Large coarse nodules reduce physical properties. 100X, reduced one-fourth.

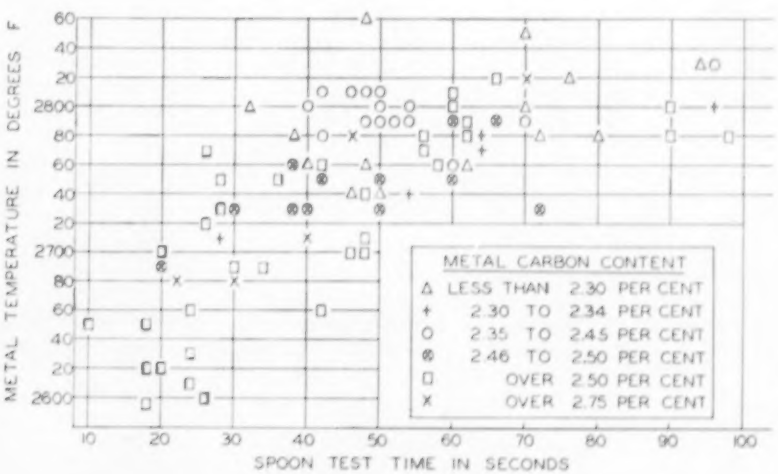

METAL TEMPERATURE IN DEGREES F
SPOON TEST TIME IN SECONDS
METAL CARBON CONTENT
Δ LESS THAN 2.30 PER CENT
+ 2.30 TO 2.34 PER CENT
O 2.35 TO 2.45 PER CENT
⊗ 2.46 TO 2.50 PER CENT
□ OVER 2.50 PER CENT
X OVER 2.75 PER CENT

Fig. 6 (right) . . Correlation of spoon test, metal temperature, and carbon content for cold melt operation.

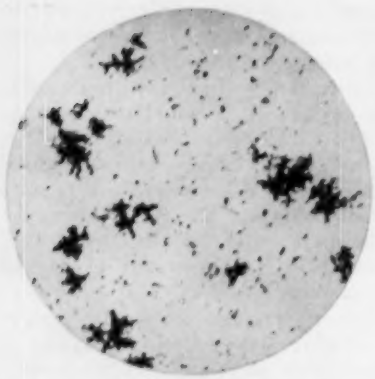


Fig. 7 . . Atmosphere rich in CO produced sprawly nodules; 2.18% C, 1.28 Si, 0.45 Mn, and 0.16 S.

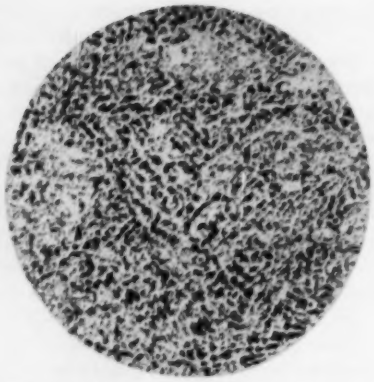


Fig. 8 . . As-cast structure of metal in Fig. 7; all photomicrographs 100X, reduced one-fourth.

Fig. 9 . . Uniform, finer as-cast structure of iron from furnace with ideal atmosphere.

has been dropped the air furnace air-fuel ratio is adjusted to increase the CO content of furnace atmosphere; to reduce carbon loss from the melt. During the refining and superheating periods, the susceptibility of melt to inoculation is reduced due to oxidizing atmosphere low in combustibles.

Since sulphur content has an influence on nodule shape, control of sulphur is essential. Desulphurizing improves the metal by making it cleaner and producing a refined grain. Keeping sulphur below 0.150 per cent minimizes tearing.

The boiling reaction of metal to the addition of soda ash removes occluded gases and non-metallic inclusions are carried out in the slag. A noticeable increase in metal fluidity is realized from the desulphurizing treatment due to removal of oxides and occludent gases. Also sulphide inclusions are reduced and refined, thereby increasing metal strength.

Experience with high-sulphur irons correlates with the investigation "The Effect of Manganese Sulphur Ration on the Rate of Annealing Black-Heart Malleable Iron" by J. E. Rehder, AFS TRANSACTIONS, vol. 56, pp. 138-151 (1948). Mr. Rehder states that an increase in the manganese-sulphur ratio results in a more irregular shaped temper carbon particle.

At Marion Malleable the matrix of an iron with 0.33 per cent sulphur and 0.60 per cent manganese contained five times as many temper carbon particles as iron with sulphur below 0.150 per cent. Annealed specimens of high sulphur iron appeared entirely ferritic at 100X. However, at higher magnification, pearlite within the ferrite grains became apparent. Nodules were very irregular in shape and physical properties were below Grade B specifications.

The author has done some preliminary work with dry nitrogen and calcium carbide injection desulphurization of gray and malleable iron. Results have been promising. Metal fluidity was increased considerably, making it possible to pour at lower temperatures. Nodule make-up is compact and microstructure contains a minimum of non-metallic inclusions. It is interesting to note that the physical properties of the annealed malleable composed of 2.56 per cent carbon, 1.28 per cent silicon, 0.52 per cent manganese, and 0.070 per cent sulphur, for 0.6265-in. diam specimen, were: 38,560 psi yield, 59,400 psi tensile, and 19 per cent elongation. Irons with carbon content this high normally have lower physical properties. The effect of injection-type treatment on sulphur contents of 0.04-0.10 per cent is being investigated.

Basically, the air furnace has been accepted as a superheating unit; primary concern is with temperature pickup. Through instrumentation and modern methods of testing, it has been found that metallurgical coal, used for superheating, influences metal characteristics and the final structure of the annealed product. The amount or air required to burn the fuel, combustion efficiency, and resultant furnace atmosphere are largely dependent upon coal composition.

Due to variation in coals, coal properties should be considered in obtaining fuel for ideal combustion conditions. Moisture can be present in all melting coals as surface moisture or as hygroscopic moisture. A nut coal ($\frac{5}{8}$ x $1\frac{1}{2}$ to $\frac{3}{4}$ x $1\frac{3}{4}$-in.) has less surface moisture than $\frac{5}{8}$-in. slack with its large amount of surface area.

For a period of three years, coal of prepared sizes has been used at Marion Malleable and many advantages have been realized. Nut coal feeds more uniformly through the pulverizer and furnace atmosphere has been more uniform. The absence of large quantities of moisture reduced air requirements and increased combustion efficiency. Moisture pickup by nut coal is negligible, making it possible to store sized coal in the open. Sized coal also creates less dust around the pulverizer.

Coal performance is influenced by the type and amount of volatile content. High-volatile coals release volatile matter rapidly during burning and require a large quantity of air to control furnace atmosphere. Since the air supply is limited, combustion is often incomplete and incompletely burned products of combustion come in contact with the metal. Low-volatile coals release gases at a much slower rate allowing complete chemical reaction with oxygen in the air. Coal of 20-22 per cent volatile content is considered a low-volatile coal.

Coals with high fixed carbon content burn uniformly throughout the melting furnace. Although fixed carbon contains some of the hydrogen, sulphur, oxygen, and

Fig. 10 (right) . . Micromottling in a ¾-in. section of iron held in reducing atmosphere.

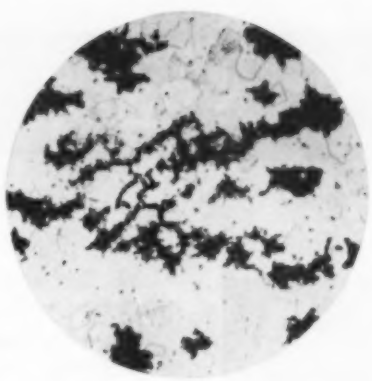


Fig. 11 (far right) . . Primary graphite is the result of inoculation of the furnace bath.

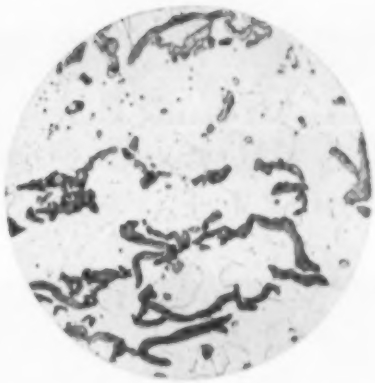


Table 2 . . Typical Analyses of a Nut Metallurgical Coal

	As Received (%)		Dry Basis (%)	
Analysis	Proximate	Ultimate	Proximate	Ultimate
Moisture	0.53	0.53	....	....
Carbon		84.33		84.78
Fixed Carbon	70.01		70.38	
Hydrogen		4.88		4.91
Nitrogen		1.33		1.40
Oxygen		4.61		4.63
Volatile	25.74		25.88	
Ash	3.72	3.72	3.74	3.74
	100.00		100.00	
Sulphur	0.54	0.54	0.54	0.54
Btu	14,909		14,988	
Grindability	98			

Typical Analysis of Ash from Metallurgical Coal

	per cent		per cent
SiO_2 Silica	51.64	Na_2O Sodium Oxide and K_2O Potassium Oxide	3.50
Al_2O_3 Alumina	33.81		
Fe_2O_3 Iron Oxide	6.55		
CaO Calcium Oxide	3.60	P_2O_5 Phosphorus Pentoxide	0.30
MgO Magnesia	0.41	SO_3 Sulphur Trioxide	0.19
		total	100.00

Ash Fusion Temperature: 2720 F

nitrogen in the coal, high combustibility of the carbon offsets heat loss due to other included elements.

Coal ash content should be low and the fusion point should be high. Silica, bases, and alumina content lower the fusion point of ash. Coals high in iron and sulphur should be avoided as their ash fuses readily to refractories.

Sources of melting fuel should be selected on basis of careful examination of proximate and ultimate analysis of their product. Carbon content of the fuel should be high to insure more complete combustion and a more desirable furnace atmosphere. Unburned fuel creates an atmosphere rich in CO, adversely affecting castability and annealability. Grindability of the fuel also affects combustion as harder coals do not pulverize to the proper fineness, thus retarding combustion and reducing efficiency. Analysis of a satisfactory, ⅝ x 1½-in. nut, metallurgical coal is given in Table 2. Note that moisture (hygroscopic), as received, in the nut coal is low. It is not necessary to run an ultimate analysis on each car of coal; proximate analysis has served well to detect coal which does not meet specification.

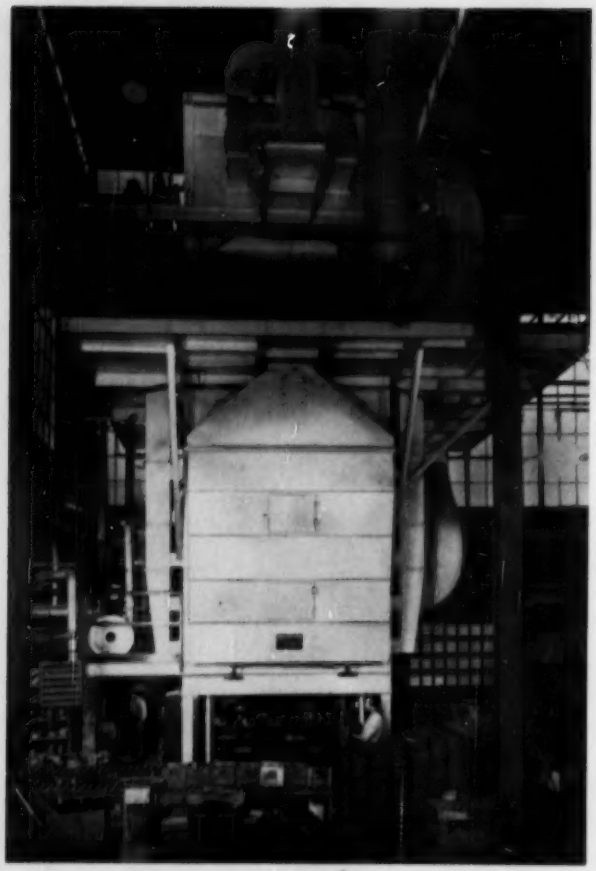
Fuels outside specification can be used if adjustments in furnace operation are made. High ash and volatiles increase operating expense by lowering furnace efficiency with increased fuel and air requirements. They also result in unfavorable furnace atmospheres. Small variations in fuel analyses may seem insignificant, but they must not be overlooked if uniform metal is desired.

At Marion Malleable specifications for metallurgical coal are: moisture, 1.50 per cent, max.; ash, 4.50, max.; sulphur, 0.70, max.; volatile, 21.5-27.5; fixed carbon, 67-75; grindability, 90, min. The ultimate analysis will show a minimum of 78 per cent carbon; 80-85 per cent is preferred. Minimum Btu requirements are 14,600 as received. All new sources are checked for pyritic sulphur before being used.

Conduct Teacher-Training Course in Brazil

Explaining use of visual aids to foundry teachers from Brazilian technical and industrial schools is Prof. Carlos Infanti, Brazilian foundryman. Working with Prof. Infanti in extending instruction of foundry work in Brazil, is Edwin W. Doe, educational consultant to the Institute of Inter-American Affairs, U.S.A. Operations Mission to Brazil. Doe is author of FOUNDRY WORK, published by the American Foundrymen's Society. Seventeen foundry teachers recently completed an intensive six-week summer course at College of Novo Friburgo, Rio de Janeiro, which included teaching methods, shop organization, safety, use of visual aids, and foundry training in the shop at Escola Tecnica Nacional, Rio. Besides teaching the usual foundry operations, technical and industrial schools teach lost wax techniques—very important in Brazil. Foundry courses of individual schools are being arranged to fit the needs of local industry. School shops are being remodeled and equipment is being installed.

LOWER FOUNDRY COSTS BEGIN WITH...



Coleman Tower® Oven

Profitable foundry operations require fast, dependable production of uniformly good cores and molds at lowest over-all cost.

Even with the best of pattern or corebox equipment, machinery, and your skilled labor, your cores and molds will be right only if they are properly baked.

Coleman Core Ovens take the guesswork out of core baking . . . eliminate wasteful rejects and make-overs . . . lower core department costs . . . do your core baking better, faster and cheaper.

Coleman Mold Ovens assure proper drying to make true-to-pattern castings whether molds are to be bone dried or skin dried.

Coleman Rolling Drawer Ovens

● WRITE FOR BULLETIN 54

Let us recommend the RIGHT type of core and mold oven for your requirements — we make them ALL.

COLEMAN PORTABLE CORE OVENS

COLEMAN ROLLING DRAWER CORE OVENS

COLEMAN TRANSRACK CORE OVENS

COLEMAN TOWER CORE OVENS

COLEMAN HORIZONTAL CONVEYOR CORE OVENS

For more facts, circle No. 513 on postage-free Reader Service card on p. 17 or 18

COLEMAN OVENS

Only COLEMAN offers a complete line of foundry ovens with all these advantages:

RECIRCULATING AIR OR DIELECTRIC HEATING SYSTEMS to meet your requirement best.

DEPENDABLE BAKING AND DRYING. Coleman Ovens remove all uncertainties in core baking and mold drying. Rejects and make-overs are eliminated.

INCREASED LABOR SAVING. Efficient and modern mechanical designs reduce handling and other indirect labor to a minimum.

HEAVY DUTY CONSTRUCTION. Responsible for dependable performance, economical operation, and minimum maintenance cost under rugged service requirements.

MAXIMUM FUEL ECONOMY. Coleman Heating Systems use the most economical fuel available to you — gas, oil, stoker-coal, electricity, etc.

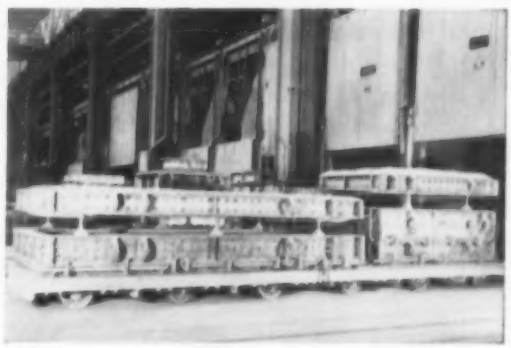
FLEXIBILITY AND ACCURATE CONTROL to bake oil or resin binders—whichever is most satisfactory for your requirements.

BETTER WORKING CONDITIONS. Positive ventilation built into Coleman Ovens prevents leakage of fumes and gases — helps to make the core department a good place to work.

WIDEST EXPERIENCE. Gained through half a century of exclusive specialization in foundry ovens and the building of more than 11,000 successful Coleman Oven installations.

Coleman Transrack Ovens

Coleman Dielectric Oven



Coleman Car Type Mold Ovens

THE FOUNDRY EQUIPMENT COMPANY

1825 Columbus Road • Cleveland 13, Ohio

WORLD'S OLDEST AND LARGEST FOUNDRY OVEN SPECIALISTS

COLEMAN CONVEYOR REDRY OVENS

COLEMAN DIELECTRIC CORE OVENS

COLEMAN CAR-TYPE OVENS

COLEMAN HIGH-SPEED MOLD OVENS

COLEMAN PORTABLE MOLD DRYERS

HOW TO BUY PORTABLE WHEELS

FOR MORE OUTPUT PER MAN-HOUR

"More Use per Dollar"

Look for a company that will engineer wheels specially to meet *your* specific requirements . . . to remove *more* metal, *faster*—at lower cost. Be sure that each type—flared cup, cone or plug and mounted points, as well as straight wheel—is bonded for its particular application and speed.

Select only the most efficient portable wheel for *your* job . . . one that combines fast cutting action with long wheel life. The type of abrasive and correct grain size should be determined by the rate of metal removal and finish your operations require. Only the right rubber or resinoid bond permits the cutting grains to do a uniform quality job at top speed. A careful analysis of these factors as they affect *your* snagging problems can best assure more pieces done per hour with your portable grinders . . . less operator fatigue and lower production costs at your plant.

Specify by name the portable snagging wheels engineered with *your* job in mind . . . specify Manhattan Portable Wheels.

MANHATTAN PORTABLE WHEELS

Individual engineering for every customer is the secret of success in Manhattan Portable Wheels for portable grinders. Every phase of the wheel you buy—type of abrasive, grain size, hardness, structure and bond—are determined by the specific requirements of your work. They are built to solve the problems at your plant . . . to remove more metal . . . faster . . . at low cost. They satisfy workers on incentive who want speed, as well as management men who want uniform quality production.

Let a Manhattan representative show you how you can get more output per man-hour and lower production costs . . . "More Use per Dollar" . . . with Manhattan Portable Wheels and other types of high speed, heavy duty abrasive wheels.

RM-642

WRITE TO ABRASIVE WHEEL DEPARTMENT

MANHATTAN RUBBER DIVISION—PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.

Other R/M products include: Industrial Rubber • Fan Belts • Radiator Hose • Brake Linings • Brake Blocks • Clutch Facings • Asbestos Textiles • Packings • Engineered Plastic, and Sintered Metal Products • Bowling Balls

For more facts, circle No. 518 on postage-free Reader Service card on p. 17 or 18

Calculations Cut to 1/15 With Slide Rule and Graph

KENNETH MACKAY SMITH / *Consultant*

It takes less than 60 seconds to make statistical quality control calculations which normally require 15 to 20 minutes. A special slide rule together with the accompanying graph make quick and easy work of setting up statistical control limits, $3\sigma_p$, from the formula

$$3\sigma_p = \sqrt{\frac{9\bar{p}\ (1-\bar{p})}{N}}$$

The graph (see following page), used to locate the decimal point of slide-rule calculations, is particularly advantageous when setting control limits for per cent defective on 15 to 20 types of defects and where large variations in daily output cause the size of sample N, to vary also.

The graph shows three curves which represent the 10.0 per cent, 1.0 per cent, and 0.10 per cent values of $3\sigma_p$ for specific combinations of $\bar{p}$ (per cent) and N. Any combination of $\bar{p}$ and N which does not produce a $3\sigma_p$ value of either 10.0, 1.0, or 0.10 per cent must necessarily produce a $3\sigma_p$ value which falls in one of the areas adjacent to the curves. The graph includes all values of $\bar{p}$ from 0.3 to 50.0 per cent and of N from 25 to 200,000 units or observations.

To make the graph, one needs a sheet of logarithmic paper 3x5-cycles, with cycles 3x3-in. for easy reading. The Y-axis is numbered from 25 to 200,000 and the X-axis from 0.3 to 50. Curves are plotted from the table of coordinates. From left to right, the curves are labled $3\sigma_p = 0.1$ per cent, $3\sigma_p = 1.0$ per cent, and $3\sigma_p = 10.0$ per cent. The areas adjacent to the curves contain $3\sigma_p$ values of the following per cent ranges: 0.0366 to 0.0999, 0.101 to 0.999, 1.01 to 9.99, and 10.01 to 30.0.

In most cases, when the technician has solved the formula on his slide rule, a quick glance at the graph will locate the decimal point. He merely reads across the X-axis to his value of average per cent defective, and up the chart to his size of sample N, noting the area in which the $3\sigma_p$ value falls. Digit-decimal point relationship is shown within circles.

Although the chart is given in terms of average per cent defective, it can just as well be in terms of average fraction defective, by simply moving the decimal point two places to the left in the values on the X-axis, and in the values for $3\sigma_p$ on the curves and in the adjacent areas.

Values from the table of coordinates should be sufficient to draw fairly smooth curves. If more are desired, they are found in the following manner:

For the 1.0 per cent curve, substitute any value of $\bar{p}$ from 0.003 to 0.50 (0.3 to 50 per cent) and 0.01 (1.0 per cent) for $3\sigma_p$ in the equation $3\sigma_p = \sqrt{\frac{9\bar{p}\ (1-\bar{p})}{N}}$

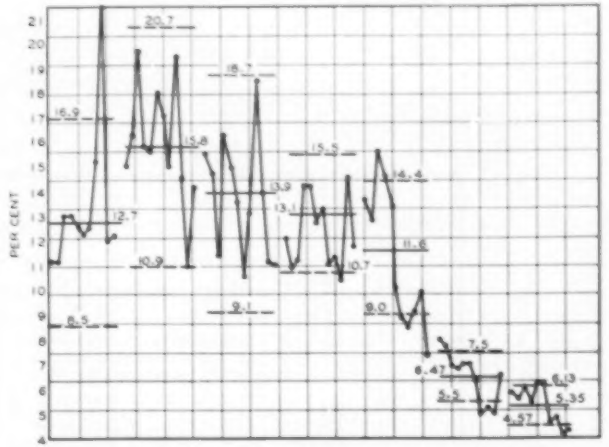
then solve for N. It will be found that the value for N is the same as $9\bar{p}\ (1-\bar{p})$, except for the decimal point. Coordinates for the 0.1 and 10.0 per cent curves are found similarly by substituting 0.001 and 1.0 respectively for $3\sigma_p$.

If slide rule accuracy is satisfactory it can also be used to locate coordinates. Close the rule exactly. In this position, the left hand "1" on the D-scale indicates the values $3\sigma_p =$ 10.0, 1.0, or 0.10 per cent. Set the hair line at any value of per cent defective on the P_o-scale, with the slide rule still closed. Don't move the hairline. Directly under the chosen value of per cent defective on the B-scale will be found the value of N. Then locate the decimal point in the N value.

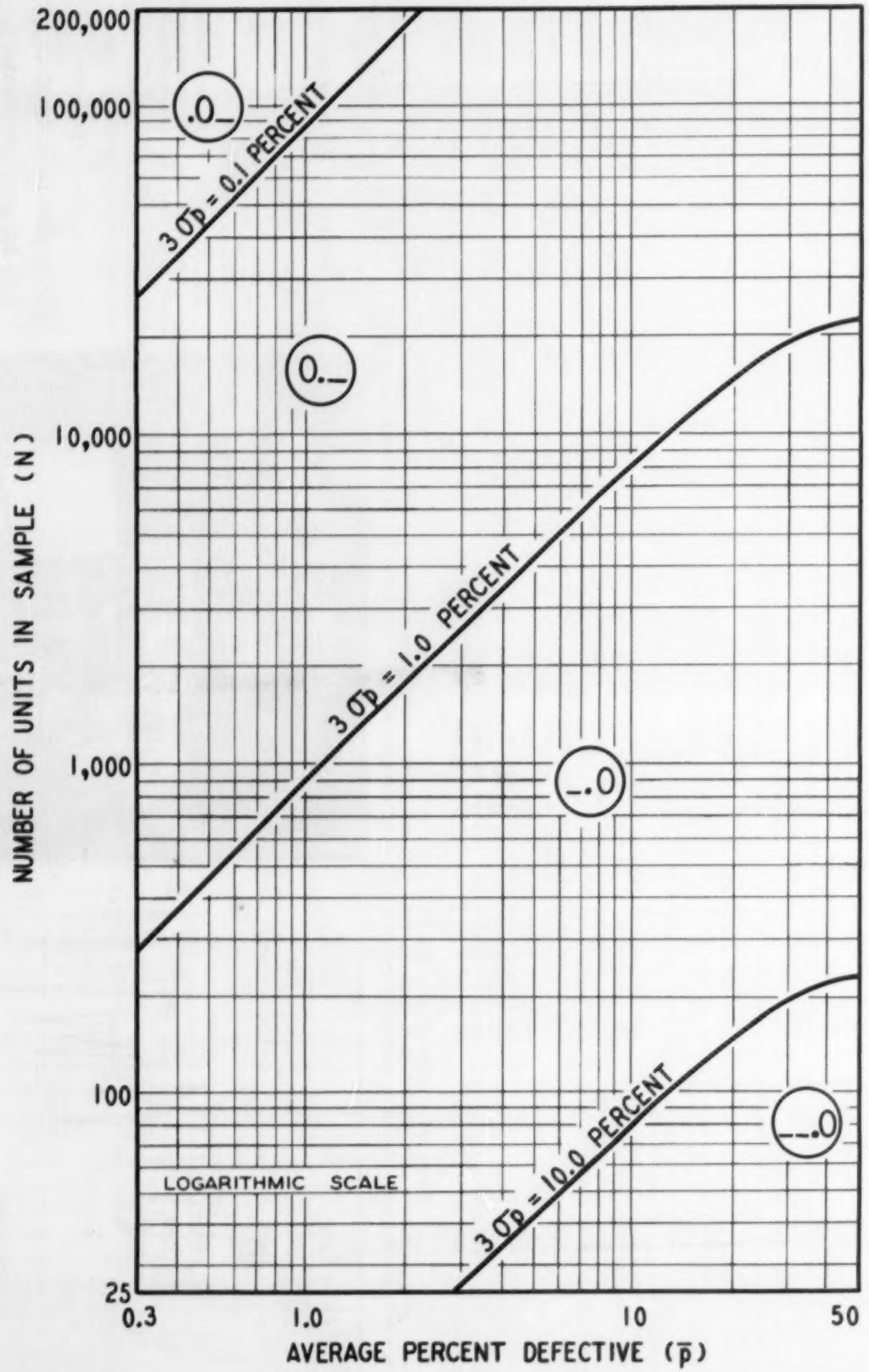
Table of Coordinates for Curves

N Units	$\bar{p}$ per-cent	N Units	$\bar{p}$ per-cent	N Units	$\bar{p}$ per-cent
		269.19	0.3	26919.	0.3
		358.56	0.4	35856.	0.4
		447.75	0.5	44775.	0.5
		536.76	0.6	53676.	0.6
		625.59	0.7	62559.	0.7
		714.24	0.8	71424.	0.8
		802.71	0.9	80271.	0.9
		891.00	1.0	89100.	1.0
		1154.79	1.3	115479.	1.3
		1416.96	1.6	141696.	1.6
		1677.51	1.9	167751.	1.9
		2000.06	2.3	200006.	2.3
25.00	2.9	2500.00	2.9		
34.56	4.0	3456.00	4.0		
42.75	5.0	4275.00	5.0		
50.76	6.0	5076.00	6.0		
66.24	8.0	6624.00	8.0		
81.00	10.0	8100.00	10.0		
101.79	13.0	10179.00	13.0		
120.96	16.0	12096.00	16.0		
144.00	20.0	14400.00	20.0		
168.75	25.0	16875.00	25.0		
189.00	30.0	18900.00	30.0		
204.75	35.0	20475.00	35.0		
216.00	40.0	21600.00	40.0		
222.75	45.0	22275.00	45.0		
225.00	50.0	22500.00	50.0		

Vent iron defectives from core cracks, unfilled ventholes, and exposed wires were reduced from 16.5 to 3 per cent by daily checking of core assemblies and charting.



Continuous improvement in per cent defective is accompanied by much closer control limits. Decimal point graph is particularly helpful in calculating these limits with quality control slide rule.



Decimal point graph shows the digit-decimal point relationship for $3\sigma_{\bar{p}}$ values within the circles.

How to Cast Pressure-Tight

Copper-Base Alloys

■ Many copper-base casting alloys are subject to unsoundness that allows the castings to leak when they are placed under pressure. These alloys are essentially solid solutions, characterized by a long freezing range and only a small amount of eutectic that freezes at a constant temperature at the moment of final solidification.

A literature survey by the Brass & Bronze Research Committee of the American Foundrymen's Society, entitled MELT QUALITY AND PRESSURE TIGHTNESS OF COPPER-BASE ALLOYS, points out that castings do not leak unless they have open channels leading from one surface to another. Gas content of the melt has a direct bearing on the extent and size of these open channels.

Most authors agree that the major cause of gas unsoundness is the decrease in solubility of hydrogen in the copper-base alloys between the temperatures at which freezing starts and is completed. Hydrogen that is liberated reacts with cuprous oxide in the alloy to form steam:

$$2H + Cu_2O \rightleftarrows 2Cu + H_2O$$

The steam, insoluble in the freezing alloy, forms bubbles or fills the voids resulting from microshrinkage. The pressure of the steam tends to prevent feed metal entering the voids, and should these voids be interconnected, they make channels across the wall of a casting through which gases of liquids may seep.

Remedy for gas unsoundness, the report points out, depends on the type of alloy. Basic in melting all types, however, is use of an oxidizing atmosphere to minimize hydrogen absorption. High-zinc brasses and manganese bronzes have little tendency toward gas unsoundness because zinc vapor rising through the melt absorbs and removes hydrogen in addition to blanketing the molten metal and keeping water vapor away. Danger of gasification in brass increases suddenly and rapidly as the zinc begins to boil and flushing with nitrogen is recommended if these alloys become gassed.

Neutral alloys (readily absorb oxygen as cuprous oxide when molten) include those with 10 per cent or less zinc, and those with low residual phosphorus, as well as all melts containing no strongly reducing element. Not included are the true phosphor bronzes.

Consensus of most writers is that these neutral alloys are best melted in air, or in a slightly oxidizing atmosphere, with no cover of slag or charcoal.

The so-called reducing alloys—scrap containing a large phosphorous residual, and melts containing aluminum, silicon, magnesium, beryllium, zirconium, etc.—cannot be degassed by oxidation treatment because all or nearly all of the easily oxidized components (the reducing constituents) would have to be eliminated from the melt before any hydrogen could be eliminated.

Melts containing phosphorus, aluminum, silicon, or minor amounts of magnesium can be degassed by passing dry nitrogen through the melt. Those containing beryllium or zirconium can be degassed with argon or helium.

Quick Gas Tests

A three-minute test for melt quality is described in the October 1953 issue of AMERICAN FOUNDRYMAN (pp. 68-71). The procedure calls for casting a small specimen against a chill block, breaking the specimen, and estimating the quality of the melt from the fracture.

Evaluation of gas content on a qualitative basis by examining a small specimen allowed to solidify in a vacuum has been described in England, and more recently in the United States (AMERICAN FOUNDRYMAN, March 1955, pp. 62-64).

How to put the vacuum test on a quantitative basis is described on pages 69-74 in this issue.

Regardless of the tests used, the following good foundry practices are recommended by the AFS Brass & Bronze Research Committee:

1. Melt only clean scrap of known composition.

2. Preheat the melting furnace to a bright red before charging.

3. Avoid preheating the metal, except to a low temperature, and do not allow metal in the melting crucible to extend into the furnace flame. Mild preheating of the charge to drive off absorbed moisture is recommended.

4. Melt heavy material first, then add light scrap to the molten pool of metal.

5. Keep the furnace atmosphere neutral or oxidizing.

6. Molten fluxes and damp charcoal may introduce hydrogen into the metal, and prevent proper contact between the molten metal and any oxygen in the furnace.

7. High-zinc brasses and manganese bronzes usually do not require degasification. Tin bronzes and some other alloys are often oxidized with a flux made up of cupric oxide, borax, and sand, followed by deoxidation with phosphor copper. However, bubbling dry nitrogen through the bath is a surer, more consistent method of degassing.

8. Avoid superheating the charge more than necessary to pour the casting without misruns or cold shuts.

9. Do not add scrap or ingot to the ladle to lower the temperature to the desired level. Allow the crucible to sit quietly while the temperature drops, so that gas can escape readily from the melt surface.

10. Make up lost zinc in the ladle.

11. Hold the lip of the pot as close as possible to the ladle, and hold the lip of the ladle as close as possible to the mold.

12. Pig remaining molten metal in metal or graphite molds—not sand molds.

13. Use sand testing equipment.

14. Aluminum paint on mold faces and chills, and on chill molds, will inhibit gas absorption by liquid metal in the mold. Apply the paint, which must have a strong resinous or oily base, to areas where cooling will be slow, such as bosses and junctions of sections.

15. Bottom gating is required to prevent dross inclusions in aluminum bronze or manganese bronze. Generous risers are essential for adequate feeding.

16. Top gating produces good castings if excessive drossing can be avoided.

17. With bottom gating, hot-shot gating into the riser is recommended.

18. Rectangular sprues reduce swirling and aspiration of air with the metal.

19. Round risers are preferred to those of any other shape.

20. Necked-down or knock-off risers reduce cleaning time by 50 per cent. Use of plaster insulators in the riser neck permits reduction of the neck by 30 per cent without danger of premature freezing.

21. Use atmospheric pressure to help castings as much as possible. This requires open risers or blind risers with cores in the top.

Foundry Trade NEWS

Rockwell Manufacturing Co. has won a top national award from the United Shareholders of America, Inc., for "meritorious achievement in the field of management-shareholder relations." Rockwell, traded "over-the-counter," has multiplied its stockholders more than 15 times in the past nine years.

American Brake Shoe Co. has taken over the air compressor business of the Defiance, Ohio, plant of the Lynch Corp. American Brake Shoe has purchased the rights to the Par air compressor manufactured by the Lynch Corp. for the past twenty years.

American Locomotive Co. has changed its name to ALCO Products, Inc. The new name has been adopted to reflect the company's increasingly diversified operations which have grown beyond its role as a leading locomotive supplier.

Union Carbide and Carbon Corp. is building new research laboratories at Parma, Ohio, a southwesterly suburb of Cleveland, to be managed by National Carbon Co., a division of the corporation. The new research laboratories will engage in basic, exploratory work. Much of the work in the new laboratory will be on solid-state physics research in the broad abstract sense as well as the practical investigation and design of materials to meet future requirements of industry. Work will be done with metallic and non-metallic compounds of carbon, as well as analogous compounds such as inter-metallics and semi-conductors.

Formation of the **March Corp.** to engage in applied technical sales of specialized products and services in the high-temperature, corrosion-resisting, and metallurgical fields has been announced recently. Its incorporators and officers, Raymond J. Shillum, Raymond Hollander, and Eugene V. Ivanso, metallurgical engineers with a combined experience of over 75 years in research, production, teaching, consulting, and technical sales, indicate that the new organization will represent a number of well established concerns in alloy and steel fabrication, and special castings fields The corporation offices are at 18101 James Couzens Hwy., Detroit.

Separate sales organizations have been set up for aluminum and for ductile iron operations at **Morris Bean & Co.** Douglas E. Scott has been named sales manager for the aluminum foundry which is located in Yellow Springs, Ohio, and Edmund C. Turner has been named sales manager for the ductile iron foundry and also for all tire molds. The ductile iron foundry is in Cedarville, Ohio.

St. Catharines Brass Works, Ltd., St. Catharines, Ontario, has opened a new foundry at 16 Smith St. in St. Catharines.

Norton Co. of Worcester, Mass., will open a new plant for the manufacture of grinding wheels on January 1, 1956, at Santa Clara, Calif. The one story plant at 2555 Lafayette St., 45 miles south of downtown San Francisco, was purchased last fall. George A. Garrison has been named plant manager.

Hewitt-Robbins Inc. of Stamford, Conn., has established a new subsidiary company which will be known as Hewitt-Robins (Netherlands) N. V. and will be located at 57 Von-Delstraat, Amsterdam. Alfred Cutler, manager of Hewitt-Robins Internationale in France, has been named manager of the subsidiary.

Texas Foundries, Inc. has announced plans to build a new steel foundry which will involve capital expenditures and additional working capital of $1,000,000. Construction started recently, and it is anticipated that production of castings will be well under way by the end of the year. Products of this foundry will be castings of carbon and alloy steel, ranging in weight from a few pounds to a ton or more, supplied mostly to the petroleum industry as valve parts, couplings, hand wheels, and miscellaneous oil field and pipeline specialties. In many instances, these castings will be quite similar to the malleable castings now being produced except that they will be designed for greater tensile strength and to resist higher pressures which are becoming more in demand from Texas Foundries' customers in the Southwest trade territory.

An initial production capacity of 2400 tons of castings per year is being provided for with sufficient area under roof for later expansion which, it is felt, will naturally follow somewhat the pattern of the malleable foundry which has grown from 2000 tons to 10,000 tons per year since Texas Foundries was established in 1939. R. S. Bradshaw, Jr., vice-president and production manager of Texas Foundries, will be in over-all charge of operations of the new steel foundry with James R. Hewitt, director of customer relations, in charge of sales and customer service.

Many of the castings produced by the Steel Foundry Div., as well as castings now being made by the Malleable Div., will be converted into finished and semi-finished products by Luftex Machine Products Co. which is an affiliated company under the management of Garland Fariss owned jointly by Texas Foundries and certain members of the foundry management staff. Luftex has complete facilities for machining all types of ferrous castings and for processing and assembling several end-use specialties sold by Texas Foundries.

For a record of only seven lost-time accidents in nearly 890,000 man hours of operation, the **Crucible Steel Casting Co.** of Milwaukee won an engraved plaque from its compensation insurance carrier.

A complete realignment and expansion of the sales department of **Climax Molybdenum Co.** has been announced. The reorganization entails the creation of three new domestic divisions including direct sales, metallurgical market development and chemical market development.

Garrett Corp. of Los Angeles has broken ground for a new $1,300,000 administrative and engineering office building, an extensive addition to its present AiResearch Manufacturing Div. plant adjacent to Los Angeles International Airport, at the corner of Sepulveda and Century Blvds.

Break Ground for New Clark Equipment Plant Addition

Adjacent to the Construction Machinery Division plant recently opened by Clark Equipment Co., Benton Harbor, Mich., two of the company's Michigan machines break ground again for a new 60,000 sq ft addition. New addition, which is being built by the Austin Co., Chicago, will include machine shop facilities, raw material storage space and engineering and administrative offices.

Clark Equipment Company's Automotive Div. has established a field office at 403 South Peoria, Tulsa, Okla., to provide complete sales, parts and service facilities for the company's line of axles, transmissions, torque converters and complete power train packages.

Midwest Precision Castings Co. Cleveland, has moved from 2790 Grand Ave. to larger, improved facilities at 10703-09 Quincy Ave. The new quarters consist of an office, engineering department, and foundry building.

Edwin L. Wiegand Co., Pittsburgh has appointed **Harold Miles and Associates** as Chromzlox sales engineering representatives in Tennessee and in Alabama north of the Tennessee River.

Free booklet describing the **Upper Kanawha Valley of West Virginia** with its industrial advantages and facilities available to industry are available to all interested industries on inquiry. The booklet contains statistics as to employment, transportation, all resources and a color map of the area. Direct inquiries to W. W. Jennings, Jr., Executive Director, Upper Kanawha Valley Development Association, Montgomery, W. Va.

Well timed to help satisfy the heavy demand for coke required by the present high level of activity in the automotive industry, a new 24-oven battery designed by its affiliate, Wilputte Coke Oven Div., was recently pushed at the Ironton, Ohio, plant of **Semet-Solvay Div., Allied Chemical & Dye Corp.**

Hewitt-Robbins, Inc., has been awarded a contract to supply two miles of conveyor belting and machinery components for the new San Manuel Copper Company mine in Tiger, Ariz., which will be the third largest copper mine in the United States when it goes into operation in 1956.

Arrangements have been made for **Pickands Mather & Co.** of Cleveland to become the exclusive sales agent for **Globe Iron Co.,** with plant at Jackson, Ohio, as well as their subsidiary, **Globe Metallurgical Corp.,** with new plant located at Beverly, Ohio, for the sale of all their products.

Starr-Kap Engineering Co., Detroit, manufacturers and designers of tools, dies, jigs, fixtures, gages, and special machinery has completed a new building program on their property at 13727 Plymouth Rd.

Plans to more than double the capacity of Canada's big aluminum smelter at Kitimat, B. C., to meet increasing United States and world demands have been announced. The new program will bring Kitimat's productive capacity up to 330,000 tons annually.

D-6 blast furnace sporting the latest fashions in air pollution control equipment has been blown in by the **United States Steel Corporation's** American Steel & Wire Division's Central Furnaces and Docks after being out of service for extensive repairs and improvements. When the glowing fuse was applied to the furnace to light it the familiar old spire in Cleveland's industrial valley began its 43rd year of service pouring out iron. It has been down for the construction progam since last August 23.

United States Radiator Corp. and **National Radiator Co.** have merged. Hereafter the merged company will carry on its business as National U. S. Radiator Corp.

Belle City Malleable Iron-Racine Steel Castings Co., Racine, Wis., has published a folder (No. 14) that is to set manufacturers of machinery and equipment to thinking on the possibilities of effecting cost savings without sacrifice of quality by using ferrous castings. This folder is worth a study by the designing engineer, purchasing agent, production manager, or owner who is finding it something of a struggle to maintain a competitive position in a field where costs are crowding him.

Lester B. Knight & Associates, Inc., celebrating its tenth anniversary, has opened new offices in the Knight Building, 549 West Randolph St., Chicago 6, Ill.

Armour Research Foundation, Illinois Institute of Technology, Chicago, has established a new department which combines the efforts of scientists, engineers, and economists in solving a variety of problems. The new department will be called engineering economics research.

Another "must" for proper Metallographic Control

The AB MICROMET ETCHER

A self-contained variable d.c. power supply for electrolytic etching of prepared metallographic specimens.

This neat compact unit is always ready to operate eliminating time consuming hook ups and delays due to battery failure.

All controls are advantageously located for fingertip adjustment. Twin type voltmeter and ammeter are positioned for ready and easy observation.

Properly identified leads for the cathode and the anode with forceps for contacting or holding the specimen are supplied. A replaceable beaker and fitted cathode clip to support either the vertical or horizontal stainless steel cathode are furnished.

Buehler Ltd.

METALLURGICAL APPARATUS
2120 GREENWOOD STREET
EVANSTON, ILL., U.S.A.

For more facts, circle No. 540 on postage-free Reader Service card on p. 17 or 18

Foundrymen

continued from page 34

William A. Roberts, president of the Allis-Chalmers Manufacturing Co. since February, 1951, died recently after a short illness. Mr. Roberts joined the Allis-Chalmers Tractor Div. in 1924 as a salesman in the Wichita, Kans., Branch. After being associated with the Allis-Chalmers sales organization in Canada for several years, he resigned to become a partner in a farm equipment distributor-dealership in Canada. In 1930 he re-joined the company at the home office in Milwaukee, and shortly after was named agricultural sales manager. In 1931 he became general sales manager of the Tractor Div., was named vice-president in charge of the Division in 1943, executive vice-president for the Tractor Div. in 1947, and a company director and member of the executive committee in 1948.

Walter A. Fletcher, sales manager of the Western Div. of E. F. Houghton & Co. for the past 14 years, died recently. He had been in sales work with Houghton on industrial oils, chemicals and mechanical leathers since 1922.

John W. Walker, 65, foundry supervisor at Caterpillar Tractor Co. for 25 years, died recently.

Dr. Francis Jesse Williams, director, Research and Development Laboratories, Baroid Div., National Lead Co., died recently at Houston, Texas. Dr. Williams became affiliated with the National Lead Co. in 1936 when he became the first incumbent of the National Lead Co. Fellowship at Mellon Institute, Pittsburgh, Pa. In connection with fellowship work which he conducted while at Mellon, he was active in solving technical production problems at National Lead Co. plants in the St. Louis area. In 1939 he was transferred to the National Lead Co. Research Laboratories at Brooklyn, N. Y., where he became head of the Research and Development Dept. From 1948 to 1950 he served as technical director of the research laboratories. During the time Dr. Williams was associated with the Brooklyn Laboratories, he was instrumental in the development of many new products, particularly in the field of lead chemicals, organic lead compounds and pigments.

A. J. Moore has been appointed eastern regional manager for Vanadium Alloy Steels, Montreal. He was formerly district manager of Montreal Bronze, Ltd.

C. E. Coghill, treasurer of Reynolds Metals Co., was elected vice-president and treasurer. **John Krey,** assistant to the president, was made vice-president, and **W. Monroe Wells,** assistant vice-president of operations, was made vice-president.

Herman Galamba, Sonken-Galamba, Kansas City, Kan., has been elected president of the Secondary Metal Institute of National Association of Waste Material Dealers, Inc. **Alper Goldberg,** Mars Metals Corp., San Francisco, has been elected a vice-president, and **Ben Kaufman,** Ajax Metal Div., H. Kramer & Co., Philadelphia, has been elected vice-president.

Woodrow W. Holden has been appointed plant manager of Dostal Foundry and Machine Co., Pontiac, Mich. Formerly he was chief metallurgist with the Foundry Div., Eaton Mfg. Co., Vassar, Mich. Mr. Holden is chairman of the Saginaw Valley Chapter of AFS.

John N. Merkle, formerly president of Franklin Balmar Corp., Baltimore, has been elected vice-chairman of the board of directors of the company. **Julius J. Kirchhof,** formerly executive vice-president, succeeds Mr. Merkle as president.

John S. Hutchins, president of Ramapo Ajax Div., American Brake Shoe Co., has been named to additional duties as president of the National Bearing Div. He is also a vice-president of the company. **Thomas W. Pettus,** another vice-president of the company and formerly president of the National Bearing Div., is assigned to over-all railroad sales for the company.

Charles M. Ruprecht, president of Electro-Alloys Div., was named executive vice-president of National Bearing Div., and **Paul L. McCulloch, Jr.,** sales manager of the Electro-Alloys Div., succeeds Mr. Ruprecht as division president.

Dr. William L. Faith, deputy director and chief engineer of the Air Pollution Foundation since the organization's formation a year ago, was elected vice-president and chief engineer by the Foundation's board of trustees.

Robert B. Murray, Jr., recently-resigned Under Secretary of Commerce for Transportation, has been appointed special assistant to the president of the Baldwin-Lima-Hamilton Corp.

Calendar of Future Meetings and Exhibits

June

1-18 . . Joint Metallurgical Societies Meeting
London, England; Düsseldorf, Germany; and Paris, France.

8-10 . . American Welding Society
Municipal Auditorium, Kansas City. Third Annual Welding Show.

15-17 . . American Society of Training Directors
Ambassador Hotel, Los Angeles. Annual Convention.

16-17 . . American Foundrymen's Society
Morrison Hotel, Chicago. Chapter Officers' Conference.

16-18 . . Malleable Founders' Society
The Greenbrier, White Sulphur Springs, W. Va. Annual Meeting.

20-26 . . International Foundry Congress
London, England. Host: The Institute of British Foundrymen.

20-July 2 . . Institute of Iron & Steel
General Assembly, Barcelona and Madrid, Spain.

26-28 . . Alloy Casting Institute
The Homestead, Hot Springs, Va. Annual Meeting.

26-July 1 . . American Society for Testing Materials
Chalfonte-Haddon Hall Hotel, Atlantic City, N. J. Annual Meeting.

September

12-16 . . Instrument Society of America
Shrine Exposition Hall, Los Angeles. 10th Annual Conference and Exhibit.

29-30 . . Missouri Valley Regional Conference
Missouri School of Mines, Rolla.

October

6-7 . . National Foundry Association
Edgewater Beach Hotel, Chicago. Fifty-seventh Annual Meeting.

13-15 . . Foundry Equipment Manufacturers Association
The Greenbrier, White Sulphur Springs, W. Va. Annual Meeting.

16-18 . . Conveyor Equipment Manufacturers Association
The Greenbrier, White Sulphur Springs, W. Va. Annual Meeting.

17-21 . . American Society for Metals
Convention Hall, Philadelphia. National Exposition and Congress.

19-21 . . Gray Iron Founders' Society
Hotel Schroeder, Milwaukee. Twenty-seventh Annual Meeting.

20-21 . . Ohio Regional Foundry Conference
Case Institute of Technology, Cleveland. Sponsored by the Northeastern Ohio, Toledo, Canton District, Central Ohio, and Cincinnati District Chapters of AFS in cooperation with Case Institute of Technology.

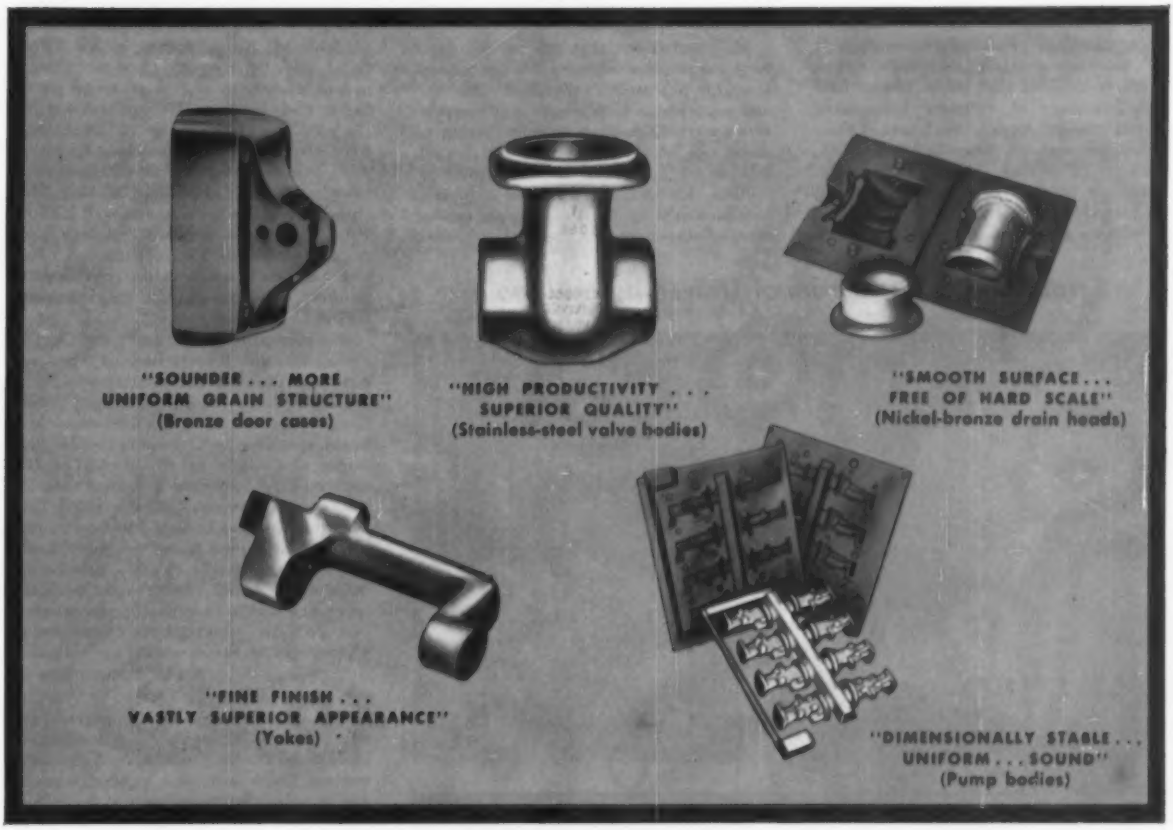
24-25 . . Steel Founders' Society of America
The Greenbrier, White Sulphur Springs, West Virginia. Fall Meeting.

November

3-4 . . Metals Casting Conference
Purdue University, West Lafayette, Ind. Sponsored by the Central Indiana and Michiana Chapter of AFS in cooperation with Purdue University.

14-17 . . International Automation Exposition
Navy Pier, Chicago.

Better castings for better end products . . .


"SOUNDER . . . MORE UNIFORM GRAIN STRUCTURE"
(Bronze door cases)
"HIGH PRODUCTIVITY . . . SUPERIOR QUALITY"
(Stainless-steel valve bodies)
"SMOOTH SURFACE . . . FREE OF HARD SCALE"
(Nickel-bronze drain heads)
"FINE FINISH . . . VASTLY SUPERIOR APPEARANCE"
(Yokes)
"DIMENSIONALLY STABLE . . . UNIFORM . . . SOUND"
(Pump bodies)

achieved by

SHELL MOLDING with G-E SHELL RESINS

Examples like these show why so many foundrymen and casting buyers are turning to shell molding. Shell molding yields smoother, sounder castings—with greater dimensional accuracy—than conventional sand-casting methods. Are *you* taking advantage of shell molding for better castings for better end products?

Ask G. E. about shell molding

General Electric offers a number of foundry products to help you benefit from the shell process: *G-E phenolic shell-molding resins* to form light, dimensionally accurate molds . . . *G-E silicone parting agents* to secure quick, easy release of molds from patterns . . . *G-E phenolic bonding resins* to cement shell halves together.

FREE BOOKLET AVAILABLE

How can shell molding help YOU? General Electric maintains a shell-molding laboratory in Pittsfield, Mass., to help users and prospective users of shell molding solve problems and evaluate the process. Also, G. E. has prepared an informative 28-page manual telling about the techniques and benefits of this new foundry method. For a free copy of *G-E Shell Molding Manual*, just write to *General Electric Company, Section 522-4B, Chemical Materials Department, Chemical and Metallurgical Division, Pittsfield, Mass.*

Progress Is Our Most Important Product

GENERAL ELECTRIC

Equipment Makers Study Dust and Fume Control

HERBERT F. SCOBIE/*Editor*

DESIGNERS of processes and equipment have a professional responsibility not to create designs that cause health hazards, members of Foundry Equipment Manufacturers' Association heard at their spring meeting in Washington, D. C., April 15. Speaking at a special session sponsored by the Dust & Fume Control Product Group, Prof. Theodore F. Hatch, University of Pittsburgh, urged process designers to work closely with dust and fume control engineers.

He pointed out that process designers have the responsibility for developing and changing processes so that dust collection and suppression is as simple and inexpensive as possible. Factors contributing to dispersion of dust and fume, Hatch said, include air movement due to equipment motion, air drag of particles dispersed mechanically by the process, air motion created elsewhere, and thermal gradients.

While the Dust & Fume Control Group held its meeting, under the chairmanship of John M. Kane, American Air Filter Co., Louisville, Ky., other product groups met separately to discuss problems peculiar to their interests. Groups meeting included: Blast Cleaning & Tumbling; Flasks, Jackets & Accessories; Furnaces & Accessories; Material Handling Equipment; and Molding & Core Making Machines. A joint session under F.E.M.A. President W. B. Wallis, Pittsburgh Lectromelt Furnace Co., Pittsburgh, Pa., was held with speakers on government-industry relations and the case for castings in foundry equipment.

In addition to Prof. Hatch, the Dust & Fume Control Group had as speakers Arthur C. Stern, U. S. Public Health Service, Cincinnati, and Einar A. Borch, National Metal Abrasive Co., Cleveland. Mr. Stern, speaking on *"Tailoring the Air Pollution Ordinance to the Needs of the Community,"* cautioned against use of stock ordinance provisions without first inquiring into local needs. Most ordinance provisions in circulation in the United States, he said, stem from a handful of large cities whose predominant problem was black smoke from combustion of high volatile bituminous coal. He declared that 95 per cent of the needs for air pollution control legislation lies in communities of less than 25,000 population.

Zoning ordinances by themselves are not sufficient since they are ineffective against residential, mobile, and portable sources, Stern said. Best legislative package is an air pollution control ordinance and a zoning ordinance, each tailored to supplement the other. If a community must choose between the two, an air pollution control ordinance alone is better than a zoning ordinance alone.

Mr. Borch, F.E.M.A. Statistical Committee chairman, discussed business conditions and cycles. Industrial product figures are not accurate, short term indicators of foundry equipment business, he stated. Foundry equipment swings, he said, precede foundry and general industry swings and are more drastic than industrial product swings.

Speaking at a joint session of all groups, Charles W. Stewart, executive vice-president, Machinery & Allied Products Institute, discussed *"Statesmanship in Government-Industry Relations."* Moving into the field of business organizations, he pointed out that they, like businesses, need money, talent, and continuity of leadership.

On behalf of all branches of the castings industry, Ross L. Gilmore, Superior Steel & Malleable Castings Co., Benton Harbor, Mich., presented *"The Case for Castings."* Half the equipment at the 1954 Convention of the American Foundrymen's Society would have benefited from greater use of castings, he declared. Foundry equipment manufacturers are a showcase for the castings industry, he said in urging the manufacturers to consult foundry engineers in designing new parts and products.

Establish F.E.F. Program at University of Illinois

At the inauguration of the Foundry Educational Foundation program at the University of Illinois were, above, left to right: Fred W. Trezise, associate dean of engineering; Prof. Roy W. Schroeder; and Dean Charles C. Caveny, all of the Chicago Undergraduate Branch. Below, left to right, are: Professors K. J. Trigger and James L. Leach of the downstate campus; F. E. F. Executive Director E. J. Walsh; and H. A. White, Smeath-Harwood Co., Chicago. Others present included Prof. N. A. Parker, head of metallurgy, downstate campus; C. V. Nass, Beardsley & Piper Div., Pettibone Mulliken Corp., Chicago; and Herbert F. Scobie, editor, AMERICAN FOUNDRYMAN.

Formal announcement that both campuses of the University of Illinois (Urbana and Chicago) will participate in the scholarship program of the Foundry Educational Foundation was made recently at a luncheon meeting called by Fred W. Trezise, associate dean of engineering, Chicago branch. The Foundation is inaugurating the program at both campuses, according to F. E. F. Executive Director E. J. Walsh, in recognition of the cooperation of the school with the castings industry and its good work in the field of foundry education. Demand for engineering graduates with foundry background and interest is higher than ever, he said, and is almost three times the supply of men available from F. E. F. schools and others who have registered with the Foundation. Mr. Walsh said the scholarship program also was scheduled to be installed at the University of California (Berkeley) and the University of Kentucky.

Memo to foundry superintendents:

Two specific points about Edco Dowmetal Bottom Boards—

✓1. the flask side is grooved and vented to permit the escape of gases— insure mold stability.

✓2. the opposite side is braced like a bridge— gives you strength without weight for safe, easy handling and long board life.

The entire board, of course, is made of light-weight magnesium.

✓Write for price schedule, and list of 83 standard sizes —

Christiansen Corporation

210 S. Marion St. · · Oak Park 2, Illinois

Edco Dowmetal Bottom Boards · Edco Aluminum Ingot

For more facts, circle No. 530 on postage-free Reader Service card on p. 17 or 18

Operated Year Without Single Lost Time Injury

For showing the greatest improvement in 1954 over 1953 in the self-improvement safety competition of the Malleable Founders' Society, the following firms were recently recognized: Class I—Oriskany Malleable Iron Co. Inc., Oriskany, N. Y.; Class II—Milwaukee Malleable & Gray Iron Works and Chain Belt Co., both of Milwaukee; Class III—Wilmington Malleable Iron Works, Eastern Malleable Iron Co., Wilmington, Del.; and Class IV—Terre Haute Malleable & Mfg. Corp., Terre Haute, Ind.

Class I foundries have fewer than 100 employees; Class II, 100 to 200; Class III, 200 to 400; and Class IV, over 400 employees.

Four companies did not have a single lost time accident in 1954. Frequency rate average for all 1954 participants dropped to 15.5 compared with 31.2 in 1951 when the safety program was inaugurated.

Lowell D. Ryan, M.F.S. managing director, associates improved working conditions, better morale, and substantial savings from reduction of lost-time accidents with an improved safety record.

Wilmington Malleable Iron Works. Receiving award from Mr. Ryan is Carmen J. Zaccaria (right) employee relations mgr.; at left is J. Henry Bruhn, plant supt.

Chain Belt Co. Safety Committeeman William Wolf receives plant award from Mr. Ryan as A. Bathke, plant safety director (far left) and Supt. J. G. Kropka look on.

Milwaukee Malleable & Gray Iron Works. (left to right) J. B. Gutenkunst, secy.-treas.; V. Langlau, prod. supv. and safety committee secy.; C. A. Gutenkunst, Jr., president; Mr. Ryan; and W. Kerner, asst. supt. and safety chairman.

Atlantic City Is Site For A.S.T.M. Annual Meeting

Seven timely symposiums will highlight 32 technical sessions scheduled for the 58th Annual Meeting of the American Society for Testing Materials to be held at Chalfonte-Haddon Hall, Atlantic City, N. J., June 27 to July 1. Symposiums, some of them continuing through three sessions, will be presented on impact testing, judgment of factors in soil testing, high purity water corrosion, atmospheric corrosion of non-ferrous metals, speed of testing, and metallic materials for service above 1600 F. Many sessions of individual papers on related subjects will cover non-ferrous metals, steel, fatigue, and effect of temperature. There will be a panel session on pyrometric practice in elevated temperature testing sponsored by the Joint A.S.T.M.-A.S.M.E. Committee on Effect of Temperature on the Properties of Metals.

Titles of some of the papers to be presented are: "Notched-Bar Testing—Theory and Practice," "A Remotely Operated Extensometer," "Mechanical Properties of a Magnesium Alloy Under Biaxial Tension at Low Temperatures," Report of Committee B-5 on Copper and Copper Alloys, Cast and Wrought," "Effect of Strain Rate-History on the Creep Behavior of an Alloy of Steel at 800 F," and "Effect of Marine and Urban Atmospheres on Aluminum Alloys."

In addition, about 50 of the Society's main technical committees and their subgroups have scheduled about 600 meetings in the 5-day period.

Dr. Hamburger to Give Lecture

The annual Marburg Lecture established by the Society to honor its first secretary will be presented Wed., June 29, by Dr. Walter J. Hamburger, director, Fabric Research Laboratories, Inc., Boston. Dr. Hamburger will speak on "A Technology for the Analysis, Design, and Use of Textile Structures as Engineering Materials."

The Gillett Memorial Lecture, sponsored jointly by A.S.T.M. and the Battelle Memorial Institute to honor Horace W. Gillett, the first director of Battelle, will be presented by Dr. Fritz V. Lenel, Rensselaer Polytechnic Institute, on Tuesday, June 28. Dr. Lenel's lecture title will be "Powder Metallurgy—Now (New Techniques, Improved Properties, Wider Use)".

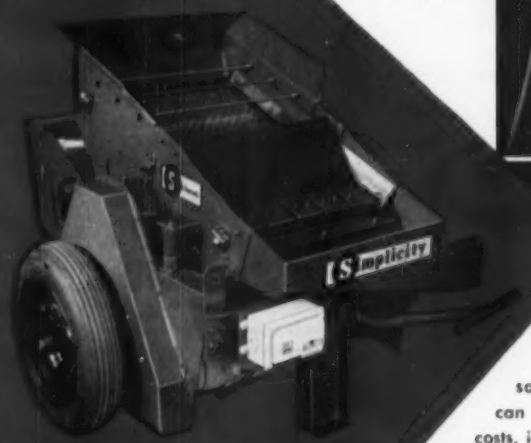
"What is It?" retiring A.S.T.M. President Norman L. Mochel will ask in his Presidential Address at the luncheon, Tuesday noon. He will discuss problems relating to the identification of materials. Various awards, including honorary memberships and recognition of 40- and 50-year members will also be a part of the luncheon program.

The A.S.T.M. dinner on Wed. night, followed by entertainment and dancing, will provide relaxation in a week otherwise filled with intensive technical activity. This event is sponsored by the Philadelphia District Council which also will sponsor a very fine program of activities for the ladies throughout the week.

SIMPLICITY PORTABLE SAND CONDITIONERS INCREASE PRODUCTION —LOWER COSTS

SCREEN, AERATE AND FLUFF IN ONE OPERATION

A SIMPLICITY 4' x 4' Portable Sand Conditioner in operation at Brown Industries Foundry, Sandusky, Ohio. Note the front end loader which is also employed to move the unit.



This SIMPLICITY 2' x 3' Portable Sand Conditioner handles 10 to 15 tons of molding sand per hour—all the sand two men can shovel. The two-wheeled model pictured, is equipped with pneumatic rubber tires 24 inches in diameter. It is especially designed for foundries with sandy or uneven floors. Three-wheel solid rubber tired models also available for foundries with hard surface floors. Screen sizes on other models range from 12" x 18" up to 4' x 5'—capacities from 2 to 40 tons per hour.

Foundries without a regular sand handling system can reduce sand handling costs, increase production, and improve the quality of their castings by installing SIMPLICITY Sand Conditioners. Designed for operation on side floors or main bays without sand systems, these compact, portable units screen out hard core butts, chills, gaggers, nails and other pieces of metal and break down hard lumps and balls into finely screened useable sand, thereby eliminating sand waste. In the same operation, the sand is thoroughly aerated and fluffed, producing molding sand with a high degree of permeability. The result: good, clean castings that require less shakeout and finishing time; fewer rejects and less scrap. Experienced foundrymen report that the savings made possible through the use of a SIMPLICITY Sand Conditioner will more than pay for the unit in six months or less.

CONSULT A SIMPLICITY SALES REPRESENTATIVE OR WRITE US TODAY FOR FULL INFORMATION.

156

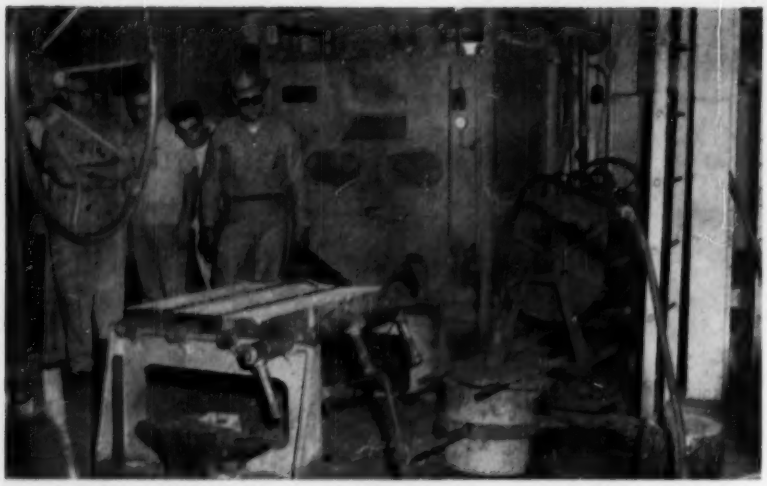
Simplicity
TRADE MARK REGISTERED

ENGINEERING COMPANY • DURAND 1, MICHIGAN

Sales Representatives in all parts of the U.S.A.

FOR CANADA: Simplicity Materials Handling Limited, Guelph, Ontario.

FOR EXPORT: Brown and Sites, 50 Church Street, New York 7, N. Y.



BIRMINGHAM . . Demonstration of carbide injection of gray iron by the Linde Process at the April meeting held at the University of Alabama.

Chapter News

No. Illinois & So. Wisconsin

The Northern Illinois and Southern Wisconsin Chapter sponsored an AFS Training Course on Fundamentals of Foundry Safety at the Beloit Vocational and Adult School, Beloit, Wis., March 24 and 25. The course has been worked up by National Headquarters Staff and the AFS Safety Committee for the benefit of the foundry industry. This year the chapter used the course as part of their educational program under the direction of Richard A. Oster, chairman of their educational committee.

The course was attended by 24 representatives from nine foundries in the area. Introduction and welcome were made Thursday morning by Howard W. Miner, Fairbanks, Morse & Co., Beloit, Wis. William N. Davis, AFS director of Safety, Hygiene and Air Pollution Program started the technical sessions with a talk on *"Basis of Foundry Safety (organizing a safety program),"* and followed with *"Foremen's Safety Conference,"* as his subject. T. A. Kraklow, Deere & Co., Moline, Ill., followed Mr. Davis with a talk on *"Foreman—The Key Man."* *"Building Safety Into the Working Force,"* was the subject of Robert Porter, Dennehy & Ulsteth, Inc., Chicago, to close the morning session.

Leonard Cole, Crane Co., Chicago, spoke on *"Machine Guarding"* to start the afternoon session. He was followed by Jess Hogans, Fairbanks Morse & Co., Beloit, Wis., who talked on *"Foundry Chains—Their Maintenance and Safe Use."* Dean Pardee, Fairbanks Morse, followed Mr. Hogans with a talk on *"The What and the How of Foundry Safety Inspection."* A materials handling demonstration on how to lift was presented by Mr. Davis to close the first day's session.

W. F. Scholtz, Allis-Chalmers Mfg. Co., Milwaukee, started the Friday session by presenting slides on *"Foundry Health—Dust Control—Good Housekeeping."* He followed this with a talk on *"Building Safety Into the Plant Housekeeping."*

"Maintaining Interest in Safety," by J. D. Holtzapple, Continental Foundry & Machine Co., East Chicago, Ind., started the afternoon sessions. He was followed by a demonstration on personal protective equipment by Floyd Van Atta, National Safety Council, Chicago. M. J. Dalton and E. J. Simek, Great Lakes Fire Equipment Co., Barrington, Ill., with a talk and demonstration on *"Fire Protection (plant fire brigade—equipment.)"*

Southern California

One hundred and seventy two members and guests were present at the April meeting held at the Rodger Young Auditorium. George E. Miller, San-Blow Div., Federal Foundry Supply Co., Cleveland, was guest speaker and his subject was *"Sand Ramming By Blowing."*

The speaker pointed out that the primary advantages of mold blowing are: accurate castings, no spillage and fast operation. He stated that the hardness of a blown core is either caused by the mixture of the sand or by the velocity of air coming through the blow holes. Soft blown cores are either caused by unvented or under-vented core boxes, or by dirty vents.

Winners of the ferrous and non-ferrous Apprentice Molders Contest as well as the winners of the Apprentice Pattern Makers Contest were guests of the chapter at the meeting. Cash prizes were presented to the winners by Emil Peschke, chairman of the Apprentice Molders Contest Committee and James Oliva, chairman of the Apprentice Pattern Makers Contest Committee.—*W. G. Stenberg.*

Birmingham

Members of the Birmingham Chapter joined with the Student Chapter of the University of Alabama for the April meeting. It was held at the University Foundry in Tuscaloosa, Ala. Over 100 members were present.

Following a barbecue luncheon, a film by Linde Air Products Co. on Desulphurization and Upgrading of Iron was shown. A practical demonstration of the process, involving the injection of carbide, cerium and magnesium into electric furnace melted gray iron was carried out in the foundry. T. W. Harwell, Southern Region engineer for Linde, directed the demonstration. Test bars poured from the treated iron were pulled in the strength of Materials Laboratory.—*J. A. Wickett.*

Western Michigan

The April meeting was held at Cottage Inn, Muskegon Heights, Mich., with John A. Van Haver presiding. Over 100 members and guests attended.

Lyle L. Clark, Armour Research Foundation, Illinois Institute of Technology, was guest speaker and his subject was *"Foundry Research Data, Covering Numerous Foundry Problems."* Mr. Clark discussed such subjects as: the possible use of vibration as a useful tool in casting; the use of fluorides as chemical inoculants in gray iron; casting titanium; factors affecting the quality of chip briquettes for melting, and some tips on shell mold equipment.

Membership chairman James Vander Meulen has resigned and has been replaced by W. J. Cannon, Nugent Sand Co., Inc.—*Wilson W. Hicks.*

St. Louis

At the April meeting the chapter played host to the Missouri School of Mines Student Chapter with 30 students and faculty making the trip from Rolla, Mo. The group made an inspection tour of the Dow Chemical Company's magnesium rolling mill in Madison, Ill., and visited the East St. Louis Castings Co. during the day and took part in the chapter's Annual Rolla Night meeting as guests.

Dean Curtis L. Wilson thanked the chapter for its support and encouragement of the student chapter and invited all members to come to Rolla on September 29 for the Missouri Valley Regional Conference, at which time the school will act as host.

Dr. A. W. Schlechten and Dr. D. S. Eppelsheimer, of the school, both presented ideas on what the school is attempting to do to prepare young men for the metal industry. D. S. Gould

showed color slides of the school's foundry in operation and described the work covered by the students.

Guest speaker for the evening was Charles A. Gray, Emerson Electric Co., St. Louis, who gave an informal talk on *"Training in Industry."* He described the processes used by his firm for the selection, placement and indoctrination of young engineers that come into the firm each year.

The meeting ended with the showing of the film *"The Male Fist"* produced by the A.C.F. Industries, showing all phases of the company's operations and facilities.

The chapter held its Second Annual Spring Dinner Dance April 16, at Norwood Hills Country Club with 250 members and guests attending. Each lady was presented with an orchid and many valuable attendance prizes were awarded. —*Jack Bodine.*

Oregon

George E. Miller, San-Blow Div., Federal Foundry Supply Co., Cleveland, addressed the chapter at the Columbia Athletic Club, Portland, Oregon, April 20. His subject was *"Sand Ramming by Blowing."* Ninety members attended the meeting.

Mr. Miller used easel mounted posters to describe how blowing machines work and what takes place when cores and molds are blown. He gave valuable tips on proper venting of core boxes, placement of blow holes and operation of types of blowing equipment distributed by different manufacturers. A series of slides picturing both core and mold blowing machines in use.—*Bill Walkins.*

Central Indiana

The final meeting of the season was held in May at the Antheneum Turners Club, Indianapolis. It was designated as Past Chairmen's night. The following past chairmen were honored: Allen Reid, General Refractories Co.; Carl Shopp, Link-Belt Co.; and Dallas Lunsford, Perfect Circle Corp.

The following officers were elected to serve during the 1955-56 season: *Chairman,* James A. Barret, National Malleable Co.; *Vice-Chairman,* Richard Brooks, Link-Belt Co.; *Secretary,* William Fitzsimmonds, International Harvester Co., and *Treasurer,* William Faucett, Electric Steel Castings Co.

Directors elected to serve three year terms were: James Garrett, Swayne Robinson; William Boyd, Mexico Refractories Co.; Larry Emery, Marion Malleable Iron Co., and Charles R. Jones, Perfect Circle Corp.

Technical chairman for the evening was C. Neese, Electric Steel Castings Co., who introduced the speaker L. D. Richardson, Eutectic Welding Alloys Corp., Flushing, N. Y.

Mr. Richardson presented, with the aid of slides, a talk on *"New Developments in Foundry Welding."* He brought out the problems of welding and their theoretical solutions. He explained the fundamentals of welding and with the aid of charts he pointed out the different types of weldments, cautioned against stresses and dis-

ST. LOUIS . . Head table at the April meeting, left to right: R. E. Hard, St. Louis Coke & Foundry Supply Co.; A. W. Schlechten, Missouri School of Mines; W. A. Zeis, W. A. Zeis Co.; Dean Curtis L. Wilson, Missouri School of Mines; F. J. Boeneker, Bronze Alloys Co.; C. A. Gray, Emerson Electric Co.; G. L. Mitsch, A.C.F. Industries; J. H. Culling, Carondelet Foundry Co.; and J. O'Meara, Banner Iron Works.

NORTHERN ILLINOIS AND SOUTHERN WISCONSIN . . W. N. Davis, AFS director, Safety, Hygiene and Air Pollution Control Program, speaking at the AFS Training Course on Fundamentals of Foundry Safety sponsored by the chapter in Beloit, Wis., March 24 and 25.

MEXICO CITY . . Attending the March meeting from left to right: Ing. Lopez Ayala, Fundicion El Rosario, S.A., Puebla; Frank Madrigal, Fundidora de Aceros Tepeyac, S.A.; Ing. V. Nacher, La Consolidada, S.A.; Sr. Carlos Barrus, Cia. Mexicana de Refractarios A. P. Green, S.A.; unidentified man from A. P. Green; N. S. Cevacevich, standing, chapter chairman; another unidentified man from A. P. Green, and Ing. F. Gonzales and Luis Delgardo Vega, Cia. Proveedora de Industrias, S.A.

FRED BROSMER

CENTRAL ILLINOIS . . Group from International Harvester Co., discussing the April meeting with the guest speaker. From left to right: Harold Ford and G. P. Phillips, both of International Harvester Co.; Clyde Sanders, American Colloid Co., guest speaker; Ralph Beebe, Roy Peak, and Ralph Green, chapter director, all of Int'l Harvester.

FRED R. YOUNG

WASHINGTON . . Newly elected officer for the chapter, from left to right: Program Chairman William K. Gibb, Atlas Foundry & Machine Co.; Chairman William Shaug, South Seattle Foundry Co., and Vice-Chairman Harold Wolfer, Puget Sound Naval Shipyard.

UNIVERSITY OF ILLINOIS (Urbana) . . George Haley, left, student chapter chairman, presents newly elected AFS Vice-President, Frank Shipley, Caterpillar Tractor Co., center, with a brief case at the March meeting. Prof. K. J. Trigger, right, looks on.

tortions and advised how to avoid them. *—Charles R. Jones.*

Michiana

New officers elected at the May meeting held at the Elkhart Hotel, Elkhart, Ind., were: *Chairman,* Fred Davis, Oliver Corp.; *Vice-Chairman,* Floyd Crowley, Benton Harbor Malleable Co., and *Secretary-Treasurer,* Vern Spears.

Directors elected for three year terms are: R. Evans, Bendix Corp.; T. Smanda, Studebaker-Packard Corp.; D. Wiest, Dalton Foundry, and B. Hull, Casting Service.

Chairman Ray Payne presented Oscar Frederickson with an AFS pin emblematic of 50 years service in the foundry. Mr. Frederickson has completed more than 53 years in the foundry industry, most of the time has been spent in one plant, the Sibley Machine & Foundry Corp., South Bend.

A movie depicting the automations of the Ford Cleveland plant was shown. *—Floyd Crowley.*

Northern California

George E. Miller, Machine Div., Federal Foundry Supply Co., Cleveland, was the guest speaker at the April meeting of the chapter. He covered his subject, *"Sand Ramming by Blowing,"* by elaborating on the following points: (1) Functions of a core blowing machine—how it works—rigging the core. (2) Blow cores vs. hand rammed cores. (3) Mold Blowing vs. core blowing. (4) Blown molds vs. hand made molds. (5) Sand mixes for core blowing. (6) How to select proper size and type core blower for your foundry.

—J. M. Snyder.

University of Illinois

Wednesday, March 23, was Industrial Night at the University of Illinois and the student chapter was host to the Central Illinois chapter. Principal speaker was Frank W. Shipley, Caterpillar Tractor Co., Peoria, Ill., and newly elected vice-president of AFS. Mr. Shipley was presented with an engraved brief case by the student chapter.

Bert Bevis brought about 30 members to the meeting from Peoria, and C. Drury and a group from General Motors in Danville, Ill., also attended the meeting.

—George Haley.

Mexico City

At the March meeting through the cooperation of A. P. Green (Cia. Mexicana de Refractarios, A. P. Green, S. A.), a film entitled *"The Industry of Industries,"* was shown. The film had to do with the manufacturing and use of A. P. Green products. A round table discussion on foundry matters followed.

The school for foundry master molders has been operating for seven weeks and over 40 men are in the class.

—N. S. Covacevich.

Northeastern Ohio

About 200 members of the chapter turned out at the Tudor Arms Hotel, April 14, to honor National Officers and Apprentices. David Clark, Jr., Forest City Foundries Co., chapter chairman, presided.

Frank J. Dost, Sterling Foundry Co., national AFS president, spoke briefly and reviewed the history of the chapter and its impact on the national organization. The Northeastern Ohio chapter has supplied seven presidents, 25 directors, and nine medalists and honorary life members to the national organization.

E. C. Hoenicke, Eaton Mfg. Co., Vassar, Mich., national regional vice-president, and president of the Foundry Educational Foundation, discussed the highlights of the past year as entailed in the reorganization of the AFS national organization.

Frank Cech, Cleveland Trade School, and national director, spoke briefly about the educational program of the chapter. D. C. Courtwright, principal, Cleveland Trade School, and J. Fintz, assistant superintendent, Cleveland Board of Education spoke about the plans for the new Cleveland Trade School and its vocational program.

Awards were presented to apprentice winners in the chapter's annual apprentice contest. They were: Wood Patterns —first, Edward Lamparyk, Modern Pattern Co.; second, Lewis Backus, Cleveland Standard Pattern Works; third, Vincent Vineziano, Model Pattern Co. Metal Patterns—first, Stanley Stobierski, Cove Pattern Works, Inc.; second, Edward Gale, Ford Motor Co.; third, Jack Shimandle, Ford Motor Co. Gray Iron—first, Carl Linger, W. O. Larson Foundry Co.; second, Isaiah Doll, Hill Acme Co.; third, Roy Lea, Fulton Foundry. Non-Ferrous—first, Andrew Greda, Wellman Bronze & Aluminum Co.; second, Gilbert Davis, Wellman Bronze & Aluminum Co.; third, Willie Pearson, Mohawk Foundry Co. Dougherty Lumber Co., awarded duplicate checks to the patternmaker winners.

A colored movie, *"Man with 1000 Hands,"* was shown to conclude the meeting. The film emphasized the immense and complex engineering problem overcome in construction of a tremendous aluminum smelting plant for Aluminum, Ltd., in the wilds of British Columbia.

—Kenneth L. Mountain.

Central Illinois

Clyde A. Sanders, American Colloid Co., Chicago, was guest speaker for the April meeting. His subject was *"The Use and Misuse of Foundry Materials."* He was introduced by Scott Roby, Peoria Malleable, who served as technical chairman. B. L. Bevis, chapter chairman, presided.

Mr. Sanders stressed how present green sand molding techniques can be improved. His talk was supplemented by many slides showing various casting defects.

—C. Turner.

Washington

The April meeting was held at the Block House, half-way between Seattle and Tacoma, Wash., where 34 members and guests were in attendance. After a short business meeting, program chairman Harold Wolfer, introduced George E. Miller, Federal Foundry Supply Co., who spoke on *"Sand Ramming By Blowing."*

The operations in core blowing were outlined from the beginning of positioning the core-box through the clamping, blowing, filling the sand chambers and to the final step of removing the core from the box.

Mr. Miller showed several posters diagraming the mechanics of core blowers and explained the terminology, such as the degree of cratering, deep sand pockets, etc. He showed how agitators may be used to remove the deep sand pockets in the core blowing operation.

In the discussion of the blow holes, Mr. Miller stated there is no sure formula for the size or number of holes that are required. This depends entirely upon each core, each machine and the sand mix.

Mr. Miller concluded his speech with slides of core blowing operations.

—William K. Gibb.

Northwestern Pennsylvania

The Erie Moose Club was the scene of an educational meeting of the chapter with David C. Ekey, Asst. Professor of Industrial Engineering, Pennsylvania State University, as guest speaker. He described the foundry engineering course at the university.

Guests of the chapter included Messrs. Thomas Kaveny, Jr., AFS director and past president of the Foundry Educational Foundation; Dr. W. Winter, Penn State College, Thomas Campbell, Behrend Center, Penn State University; J. F. Anthony, principal, Erie Technical School; H. C. Gillespie, principal, Strong

HAROLD WHEELER, ALLYNE-RYAN FOUNDRY CO.

NORTHEASTERN OHIO . . Frank J. Dost, left, president of American Foundrymen's Society and Sterling Foundry, Wellington, Ohio, passes out cash awards to apprentice molders Gilbert Davis, center and Andrew E. Gerda, right, both employees of Wellman Bronze & Aluminum Co., Cleveland. Gerda and Davis finished one, two in the non-ferrous division of the Chapter's competition to select entries in the national contest.

CENTRAL MICHIGAN . . Committee chairmen for the Annual Outing, top row, left to right: Charles Rowley, Bliss Mfg. Co., bait casting; Stuart Yntema, U. S. Graphite Co., golf; Dave Sherman, Engineering Castings Co., general chairman; Robert Stanley, Midwest Foundries, food and arrangements, and R. L. Daniels, Albion Malleable Iron Co., tickets. Seated, left to right: Glen Ekdahl, Engineering Castings Co., softball; Dore Triponi, Michigan State University, horseshoes, and Mike Masternak, AMICo., casting weight guessing. Committee met prior to the regular April meeting.

FRED RIDENOUR, WHITING CORP.

CHICAGO . . G. O. Lawrence, left, and W. W. Moor, Burnside Steel Foundry Co. at the April meeting of the Chapter.

MICHIANA . . Oscar Fredrickson, left, receiving his 50-year pin from Roy Payne, Sterling Brass Foundry, chapter chairman, at the May meeting. Mr. Frederickson has completed more than 53 years in the foundry industry, most of this time has been spent in the Sibley Machine & Foundry Corp. plant.

KEN SHECKLER

SOUTHERN CALIFORNIA . . William C. Baud, Mechanical Foundries Div., Food Machinery Co., left, vice-president of the chapter, introducing guest speaker George E. Miller, San-Blow Div., Federal Foundry Supply Co., Cleveland, at the April meeting.

BILL WALKINS

OREGON . .George E. Miller, Federal Foundry Supply Co., Cleveland, addressing the April meeting.

Vincent High School; Dr. Leroy Baker, Academy High School, and Dr. M. E. Kolpien, superintendent, Erie County Schools.

Mr. Anthony told of the planned foundry in the new million dollar Erie Memorial Technical High School and the fine cooperation of the Northwestern Pennsylvania chapter. Bailey D. Herrington, Hickman-Williams Co., and chapter chairman, presided at the business meeting.—*Roy A. Loder.*

Texas

Twenty members and guests were present at the April San Antonio Section meeting held at Alamo Iron Works. A safety film, *"A Gray Day for O'Grady,"* was shown, followed by a general discussion on modern production molding. Following the meeting, refreshments, sponsored by Alamo Iron Works, were served.

—*George H. Hartwell.*

Corn Belt

Cushman Motors and Northwestern Metals, Lincoln, Neb., were hosts for the April meeting of the chapter held at Cushman Cafeteria.

Two color films were shown. The first was entitled *"Steel Man's Servant"* and was filmed by U. S. Steel Co. It showed the workings of a rolling mill from start to the finished product.

The second film, *"Steel With 1000 Qualities,"* was furnished by Lebanon Steel Foundry. It described the making of steel castings of all types. The film stressed the fact of good equipment, proper design of pattern and good workmanship necessary to produce a good casting.

Officers elected for the coming year were: *Chairman,* Vern Holmes, Paxton Mitchell Co., Omaha, Neb.; *Vice-Chairman,* John Glennon, Omaha Steel Works, Omaha, Neb., and *Secretary-Treasurer,* James Brinn, Northwestern Metals Co., Lincoln, Neb.

Directors elected were Earl White, M. A. Bell Co., St. Louis, and Harold Hansen, Paxton Mitchell Co., Omaha, Neb.

Attendance at the meeting were 39 members and guests.

—*Eugene B. Hagedorn.*

British Columbia

G. E. Miller, Federal Foundry Supply Co., Cleveland, was guest speaker at the April meeting and his subject was *"Sand Ramming By Blowing."* Thirty-eight members saw slides which illustrated various mold and core blowing installations while Mr. Miller explained the functions and advantages of this procedure.

Four Educational Sessions were also held during April. On April 6, 35 members attended the first of the four sessions, which was organized by J. McCulloch, Canadian Sumner Iron Works, Ltd. The chapter is indebted to Vancouver Vocational Institute which allowed the use of their facilities and testing equipment for demonstrations.

Presiding for the evening was Prof. Wm. Armstrong, a past chairman of the chapter, and he discussed the definition, use and advantages of the following tests: Vickers, Brinell, Rockwell, transverse, tensile and impact tests. Castings, ferrous and non-ferrous, supplied by the local foundries were then subjected to the various tests and results were clearly understood.

"Refractories for the Foundry Industry," was the subject of the second session held April 13. R. Davies, General Refractories Co., San Francisco, showed a recent movie on the manufacture of fire bricks and later discussed the various grades of fire clay brick, high-alumina brick and the basic bricks, chrome and magnesite. Twenty-five members attended the meeting.

The April 20 meeting brought together 30 members for a panel discussion on *"Sand Mixing, Properties and Control."* Panel consisted of Sam Stewart, Canadian Sumner Iron Works, Ltd.; James Sturrock, Associated Foundry, Ltd.; and Gordon H. Frankforth, Georgia Foundry, Ltd. Panel moderator was Lovick Young, A 1 Steel & Iron Works, Ltd. These gentlemen represented a cross-section of the industry covering non-ferrous iron and steel with their various methods of handling the sand problems encountered.

Addison Steeves, Scott-Foster, Ltd., arranged the fourth and final gathering at his company's plant. *"Shipping, Grinding, Cleaning and Welding of Castings"* were discussed, followed by demonstrations. Mr. Steeves covered the subject of *"Resin and Vitrified Bonded Grinding Wheels"* while P. R. Maitland, Dominion Oxygen Co., discussed the use of a cutting torch with powder nozzle adapter, utilizing iron, aluminum and sodium carbonate powders. Final speaker of the evening was J. A. Lindsay, Scott-Foster, Ltd., who spoke on the arc-air process and arc welding with an explanation of the various electrodes available. The meeting, which included practical demonstrations, was attended by 42 members.—*J. T. Hornby.*

Quad-City

Guest speaker G. A. Pealer, General Electric Co., Elmira, N. Y., was introduced by technical chairman Eric Wellander, John Deere Malleable Works, at the April meeting, held at Hotel Fort Armstrong, Rock Island, Ill. *"Romance of Metals"* was the subject and Mr. Pealer traced the history of founding from its earliest known work to modern production in this country. The speaker followed this with a discussion of patterns, their costs and relationship to final casting costs. It was emphasized that the end result, the number of castings to be made, should be the primary consideration in determining the type of pattern to be made. The casting cost is normally lower when higher priced patterns are used, if warranted by production demand.

The talk was followed by a sound movie on water pollution and methods of its elimination.—*G. F. Thomas.*

Twin City

The April meeting was held at the Covered Wagon Restaurant, Minneapolis, and the following officers were elected for the coming year: *Chairman,* H. H. Blosjo, Minneapolis Electric Steel Cast-

APPROVED and PROVED
NATION WIDE!

"SW" CUPOLA COLLECTOR PICKED FOR PERFORMANCE AND MONEY-SAVING VALUE

More and more foundries, small and large, are realizing the benefits from the performance of Schneible "SW" Cupola Collectors for control of cupola fly-ash and smoke.

Since such improvements are major expenditures it is important that purchase of *Cupola Collector* equipment be based on *proved performance* to assure maximum dollar value with minimum maintenance, and long usefulness.

Be sure to investigate the many benefits that are yours with Schneible "SW" Cupola Collectors, before you decide on any *similar* equipment. Only Schneible patented features gives you all the money-saving advantages.

YOUR BULLETIN ON REQUEST

For the complete story on the "SW" Cupola Collector write today for your copy of Bulletin No. 554.

CLAUDE B. SCHNEIBLE COMPANY
P. O. Box 81, North End Station Detroit 2, Michigan

EUROPEAN LICENSEE: ELEX S. A., ZURICH, SWITZERLAND
CABLE ADDRESS FOR FOREIGN INQUIRIES: CBSCO

SCHNEIBLE

PRODUCTS
Multi-Wash Collectors • Uni-Flo Standard Hoods • Uni-Flo Compensating Hoods • Uni-Flo Fractionating Hoods • Water Curtain Cupola Collectors • Ductwork • Velocitrap • Dust Separators • Entrainment Separators • Settling and Dewatering Tanks • "Wear-Proof" Centrifugal Slurry Pumps

PNEUMATIC SAND RECLAMATION

Superior Foundry Company cuts new sand consumption by 60%

Last year Superior Foundry Company, Cleveland, Ohio, installed a National Pneumatic Sand Recovery System. Here's their progress to date:

ON CORES

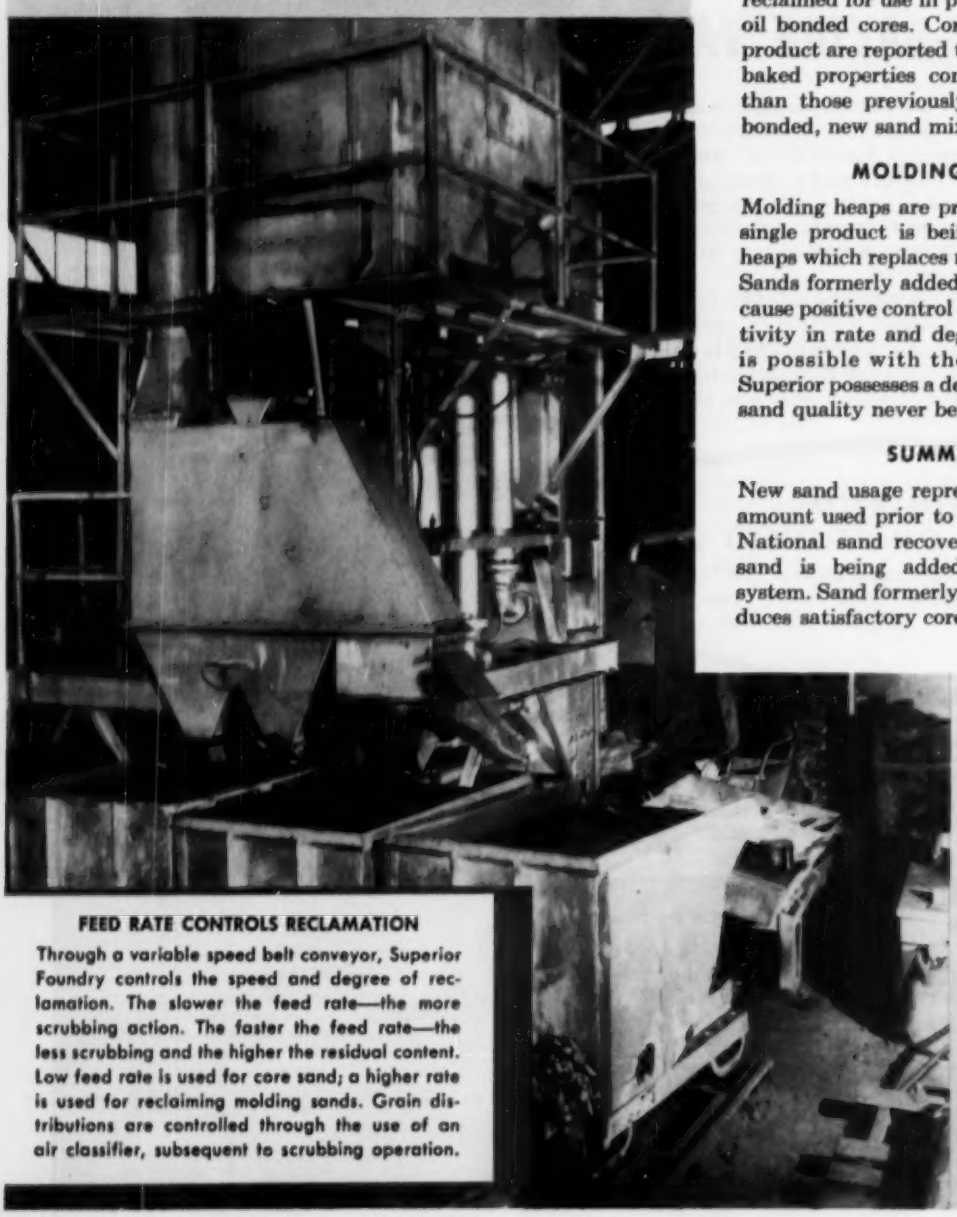
About 90-95% of the waste core knockout sand fed into the system is being reclaimed for use in place of new sand for oil bonded cores. Cores of the reclaimed product are reported to possess green and baked properties comparable, or *better*, than those previously made from, like-bonded, new sand mixtures.

MOLDING SAND

Molding heaps are processed at night. A single product is being returned to the heaps which replaces new Lake and Bank Sands formerly added to the system. Because positive control over fines and selectivity in rate and degree of reclamation is possible with the National Unit, Superior possesses a degree of control over sand quality never before possible.

SUMMARY

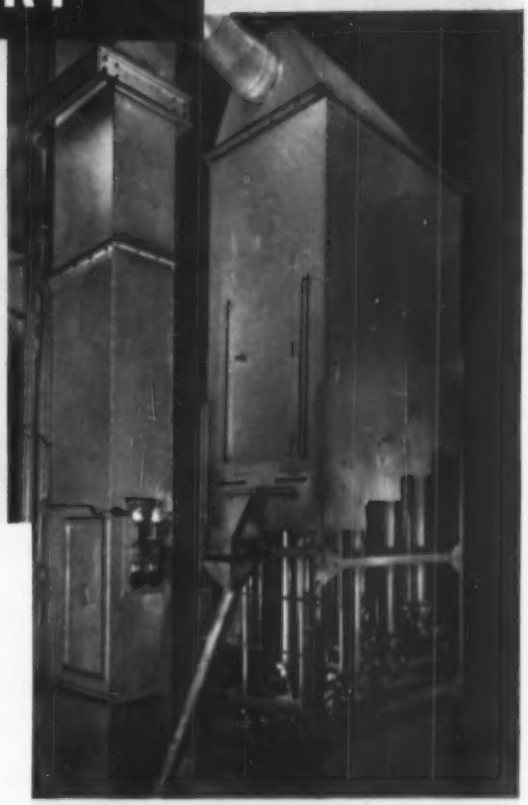
New sand usage represents only 40% of amount used prior to the addition of the National sand recovery system. *No* new sand is being added to the molding system. Sand formerly discarded now produces satisfactory cores.



FEED RATE CONTROLS RECLAMATION

Through a variable speed belt conveyor, Superior Foundry controls the speed and degree of reclamation. The slower the feed rate—the more scrubbing action. The faster the feed rate—the less scrubbing and the higher the residual content. Low feed rate is used for core sand; a higher rate is used for reclaiming molding sands. Grain distributions are controlled through the use of an air classifier, subsequent to scrubbing operation.

IN GRAY IRON FOUNDRY

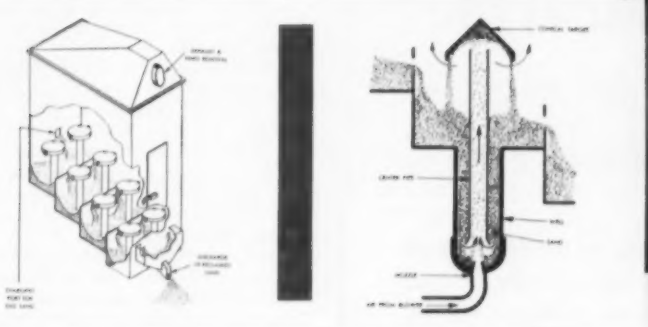


THE NATIONAL PNEUMATIC SAND RECOVERY SYSTEM

Using *low pressure air* (4.0 PSI and less) as its motivating agent, and the sand grains themselves as the abrasive body, National's Pneumatic Sand Recovery System is the first practical method for bringing controlled, *economical* reclamation within the budget of foundries everywhere. Simple in design and construction, operation and control, the National Scrubber requires little floor space, no additional labor and can be readily integrated into most sand handling systems.

There's no sludge disposal problem or plumbing worries. High recovery and low initial cost are combined with low maintenance to contribute tremendous savings over a short period of time.

Write for details today, or ask your National agent to show you savings figures, as reported by present users.



NO MOVING PARTS TO WEAR. HERE'S HOW AIR DOES THE WORK!

The National Recovery Unit is comprised of a sequence of scrubbing cells. A turbine type blower supplies a high velocity air stream to elevate the air/sand mass through a vertical center pipe. As they collide with other grains within the peak of the conical target, individual sand grains act as the abrasive. The sand grains fall back to the main sand mass while the air escapes upward at the periphery of the "targets" and carries fines and particles of grain coatings to be removed by the exhaust unit. Control of fines may be adjusted by varying the exhaust velocity.

Small openings in the partitions between successive cells permit sand passage onward to succeeding cells. The rate at which the grains pass through a cell sequence is directly related to, and controlled by, the rate at which sand is being fed into the scrubber.

SEND FOR BULLETIN 512
for full details including operation data, arrangements and reports from present users.

National Engineering Company
(Not Inc.)
630 Machinery Hall Bldg. • Chicago 6, Illinois

PRODUCTS OF A PRACTICAL FOUNDRYMAN

Small wonder! Paraspray, the modern, moistureproof core and mold surface conditioner comes ready to use, dries in seconds. Paraspray saves time, cuts the risk of blow-outs and porosity caused by moisture penetration. The reason—Paraspray is made especially for application to green or dry sand molds, cores, chills, matchplates, sprues and inserts. It effectively stabilizes moisture content (no gain or loss), enables the storage of molds for days before pouring. The results—no time wasted on the job, cleaner, smoother castings at a greatly reduced labor cost!

Gentlemen: Please rush complete data and prices concerning Paraspray and other Para Products.

COMPANY NAME .....

ADDRESS .....

Dept. C-2

Para PRODUCTS
5200 River Road, Bethesda, Md.

FOUNDRY RUBBER, INCORPORATED

For more facts, circle No. 543 on postage-free Reader Service card on p. 17 or 18

FRED RIDENOUR, WHITING CORP.

CHICAGO . . At the speakers table at the April meeting from left to right, J. T. Moore, Wells Mfg. Co. chapter vice-president, and G. Anselman, Foundry Services, Rockton.

ings Co.; *Vice-Chairman*, J. H. Roth, Progress Pattern & Foundry Co., St. Paul, Minn.; *Secretary-Treasurer*, Lillian K. Polzin, Minneapolis Chamber of Commerce.

Directors elected for three-year terms were: D. B. Fulton, Northern Malleable Iron Co., St. Paul; R. J. Mulligan, Archer-Daniels-Midland Co., Minneapolis; C. W. Sundberg, Minneapolis Electric Steel Castings Co., and N. E. Wisner, Foundry Supply Co., Minneapolis.

The evening program was devoted to a panel discussion on *"Practical Quality Control."* R. M. Ovestrud, Minneapolis Moline Co., was moderator of the panel which included: H. H. Blosjo, Minneapolis Electric Steel Castings Co.; J. J. Uppgren, Northern Ordnance, Inc.; F. J. Birchem, Northern Malleable Iron Co., and Ralph Brown, Minneapolis Moline Co. The speakers, representing steel, gray iron, malleable and non-ferrous shops, each outlined quality control practices followed in their own shop.

Panel speakers stressed the need for complete cooperation for all the personnel concerned with making the castings. They must appreciate the objectives of the quality control department and realize the mutual benefits the entire shop will enjoy through the production of sounder and more saleable castings. Quality control embraces all phases of the manufacture of a casting and, as such, the responsibility for controlled operations in each step must rest on the individual concerned with each specific operation.

Basically, the panel agreed that quality control in operation involves, first, establishing practicable specifications for a particular job and, secondly, rigid adherence to the specifications.—*R. J. Mulligan.*

Chicago

Titanium and its casting characteristics, and announcement of new officers and directors highlighted the May 2 meeting of the Chicago Chapter. Technical speaker who discussed titanium was J. Harry Jackson, Battelle Memorial Institute, Columbus, Ohio. Chairman of the technical session was L. L. Clark, Armour Research Foundation, Chicago.

Mr. Jackson said that titanium has been oversold like a Hollywood production. Nevertheless, he said, alloys of titanium give economical service in the 400-800 F range, and practical melting furnaces are now commercially available.

IMPROVE YOUR CASTINGS SIMPLY AND ECONOMICALLY

A few advantages . . .

- Greatly reduced porosity
- Cleaner castings
- Elimination of chemical and gas flushing
- Improved physical characteristics of casting
- Utilization of lower grade secondary metals

The new Kinney Mobile Vacuum Degasser with its efficient Kinney Model KDH-130 Vacuum Pump provides rapid pump-down to low pressures. The pump is effectively gas ballasted for eliminating contamination by water and other condensable vapors — a primary requirement for efficient foundry operation.

The complete unit is designed and manufactured by Kinney especially for the foundry industry. It eliminates costly impregnation processes, is simple to operate, and rugged in design . . . dependable, trouble-free, efficient. It will pay you to get the full story. Our district offices in Boston, New York, Philadelphia, Cleveland, Chicago, and Los Angeles are all competently staffed to discuss your vacuum requirements.

SEND THIS ➡ ➡ COUPON FOR MORE INFORMATION

KINNEY MFG. DIVISION
THE NEW YORK AIR BRAKE COMPANY
3637 WASHINGTON STREET • BOSTON 30 • MASS.

Please send Bulletin describing the Kinney Mobile Vacuum Degasser.

Name .....
Company .....
Address .....
City ..... State .....

For more facts, circle No. 524 on postage-free Reader Service card on p. 17 or 18

Jackson presented movies from Pitman-Dunn Laboratories, Frankford Arsenal, Philadelphia, showing factors involved in melting titanium in an inert atmosphere and pouring directly into a mold attached to the furnace. He showed slides of test castings from coated and uncoated shell molds of various materials. Castings with good finish were produced from molds of any material coated with zirconium oxychloride wash.

In presenting his report as retiring president of the Chicago Chapter, Robert L. Doelman, Miller & Co., commended the 83 committee workers who carried on chapter activities during the past year. He also thanked the officers and directors for their cooperation, calling attention to the success of the regular technical meetings, the traditional Ladies Night, the golf outing, and the educational lecture series. He called on Clifford Sorenson, National Malleable & Steel Castings Co., who reported as membership chairman that the chapter had fallen to second place in number of members with the Northeastern Ohio Chapter heading the list.

New officers for 1955-56 are: *President*—James T. Moore, Wells Mfg. Co.; *Vice-President*—Robert P. Schauss, Werner G. Smith, Inc.; and *Secretary*—Dan R. Jones, Illinois Clay Products Co. Incoming directors are W. O. McFatridge, International Harvester Co.; H. M. Krueger, National Bearing Div., American Brake Shoe Co., and E. Eugene Ballard, Lester B. Knight & Associates, Inc.

Appointed treasurer subsequent to the meeting is Louis J. Jacobs, S. Obermayer Co.

The April meeting was divided into four sections. At the non-ferrous session *"Natural or Synthetic Sands"* was the subject of G. W. Anselman, Foundry Sand Consultant. He pointed out various advantages in synthetic sand over natural bonded sands.

At the steel and maintenance session George D. Lawrence, American Bridge Co., spoke on *"Electric Furnace Operation and Maintenance."* He cited various examples on where to reduce maintenance and operational costs.

Lyle Jenkins, Wagner Malleable Co., and Puttnam Volkmar spoke on *"Production and Characteristics of Pearlitic Malleable and Ductile Irons"* at the malleable and gray iron session. They supplemented their speech with various graphs and cost data.

"Patterns for the Atomic Age" was the subject of Carl J. Johnson, Western Foundry Div., Consolidated Foundries, at the pattern session.—*J. S. Groh.*

Mo.-Kan.

The April meeting of the Mo-Kan Chapter was held at the Fairfax Airport, Kansas City, Kan. The nominating committee, which was represented by Lloyd Canfield, Canfield Foundry Supply & Equipment Co.; R. A. Posch, Arpocalloy Co., and E. F. Whitfill, Whitfill Pattern Works, submitted a list of new officers for the coming year.

Program for the meeting was the showing of two films, *"Steel With A Thousand Qualities,"* which covered the operations of the Lebanon Steel Foundry, Lebanon, Pa., and *"Steel,"* produced by the United States Steel Corp.—*Howard Julian.*

Eastern New York

Dr. Bruce Chalmers, Professor of Metallurgy at Harvard University, spoke on *"Solidification of Metals,"* to a gathering of 150 members and guests at the annual joint meeting of the Eastern New York chapters of AFS and A.S.M., on April 12, at Panetta's Restaurant.

WESTERN MICHIGAN . . Lyle L. Clark, Armour Research Foundation, Illinois Institute of Technology, guest speaker at the April meeting.

Do You Use Old Fashioned Core & Mold Washes?

Mabco Hi-Resist, a finished *ZIRCON* wash, is mixed simply with water. After oven or torch drying, Mold is ready for use.

MABCO *HI-RESIST* is Cheaper, Faster, More Efficient, and CLEANER!

Check the following features --

- √ **High Refractory Value — above 3700° F.**
- √ **Plastic Form — Stays in suspension.**
- √ **Water Insoluble and Waterproof after dry.**
- √ **Controlled Penetration — Closes pores to a depth of 5 to 7 sand grains.**
- √ **Totally Inert to any metal or alloy far above pouring temperatures.**
- √ **Excellent Ladle Wash — Is not wetted by molten metal.**

Save time and Money with these other fine Mabco Core and Mold Washes.

MABCO AP (all purpose)

Low cost ingredients and high value efficiency — Mabco AP undergoes a RADICAL color change upon drying. High permeability for quick drying mold surfaces.
High refractory value (3150°) Miscible with either water or alcohol. Alcohol gives faster drying, greater penetration.

MABCO Heavy Plastic

A base material for steel and gray iron core washes, refractory material is added by user to meet specific requirements. (Mixing instructions with orders). Gives smooth surface when dry and is highly resistant to moisture. Cores may be stored for considerable length of time without noticeable deterioration.

M. A. BELL COMPANY
218 Lombard St. · St. Louis, Mo.
Serving the foundry industry for over 25 years
HOUSTON DENVER

For more facts, circle No. 539 on postage-free Reader Service card on p. 17 or 18

In discussing solidification, Dr. Chalmers went into a detailed explanation of what occurs from the time molten metal first fills a mold till such time as it becomes a complete solid. He said this explanation is relatively simple for a pure metal but becomes highly complicated when we consider solidification on binary and other alloys. The speaker, through slides, demonstrated the changes that take place in the metal structure during solidification insofar as size, shape and orientation of crystals is concerned. He also mentioned the redistribution of various chemical elements that occur during solidification.—*L. J. DiNuzzo.*

Philadelphia

The April meeting was held at the Engineers Club, with approximately 100 persons attending the dinner and business sessions.

Technical chairman was George Gough, Rolle Mfg. Co., who introduced the guest speaker, Charles W. Mooney, Olney Foundry Div., Link-Belt Co., Philadelphia. Mr. Mooney spoke on *"Guide To Core Mixtures."*

The function of a core, he said, may be to form internal cavities surrounded by metal, or to make it possible to draw some portion of the external surface of a casting from the sand which naturally would not permit this. To serve usefully, a core must be strong enough in the process of preparation to retain its form without deformation in handling and baking. After baking, it must be sufficiently strong to resist erosion and deformation by metal during the filling of the mold. To make a true form for the casting, it must have a minimum of contraction and expansion. The core must have sufficiently low residual gas forming materials after preparation to prevent excess gas from entering the metal, and the metal must remain quiet in contact with the core during pouring and solidification to minimize strains on the casting and to make its removal from the casting easy during the shakeout.

In discussing the basic materials which go into the making of most cores, Mr. Mooney pointed out, that cores are composed of approximately 95 per cent sand, therefore, it is most important that great care be taken in the selection of the proper sand for the type of casting to be produced.

Core oil, he said, should possess dispersing properties so as to coat the grains of sand evenly, with a reasonable amount of mixing. He said there are several different types of cereals but the most common is the corn flours. In different brands of corn flour there may be a weight variation, so the proper way to get the best results in core mixes is to add it by a weight method, and not by measure, such as scoops or cups. Water, he said, is used in core mixes for green bond. Sufficient water to wet all sand grains is needed, but no more. Cores with just the right amount of water are good cores, but further addition of water, not only slows down the baking time, but can cause a core which reacts violently upon contact with metal, and result in a bad casting.

A report was presented by E. Zeeb, educational committee chairman, covering a number of round table meetings over and beyond the monthly technical sessions which were held during the year.

Three meetings were held in each division—non-ferrous, gray iron and steel. One meeting a month was scheduled for each group on separate nights, feeling this would enable the men to attend as many or all nine meetings if they so desired.

Prepared questions were printed and distributed in advance to both the discussion leaders and to the people in each group. This allowed some time for thought and preparation for discussion on each question.

The non-ferrous meetings were held at the Engineers Club, Philadelphia, January 17, February 21 and March 21, 1955. Discussion leaders were: Roger Keeley, Ajax Metal Co.; Donald Bryden, Philadelphia Bronze & Brass Co., and Charles Knobeloch, R. Lavin & Sons.

Two of the gray iron meetings were held at the Olney Foundry, Philadelphia, January 21 and March 18, 1955. Discussion leaders were Henry Winte, Florence Pipe Foundry & Machine Co., Florence, N. J., and Steven Buzak, DeLaval Steam Turbine Co., Trenton, N. J. This same group had a plant visitation on February 18, at United States Pipe & Foundry Co., Burlington, N. J., with approximately 140 people present. They had films and the actual production of centrifugal castings.

The steel group had three meetings at

HERE'S PROOF... AND A PROMISE of increases in Service Life up to 100% with . . . . .

WALSH MULLITEX SUPER DUTY FIRE BRICK

In non-ferrous melting operations, Mullitex, Dry Press Process, Missouri Quality Fire Brick has demonstrated its superiority by actually producing increases in service life up to 100%.* Not in one single instance on record has Mullitex failed to show an appreciable increase in length of service.

Isn't this the kind of performance you want in your rotary or stationary furnaces. The facts are all here for you. Write today for complete details.

*Names on request.

NOTE: And for added savings Mullitex Fire Brick laid up with Mullitex Extra Duty Cement is the *perfect combination.*

WALSH REFRACTORIES CORP

101 Ferry Street • St. Louis 7, Missouri

For over 60 years manufacturers of high grade refractories

For more facts, circle No. 549 on postage-free Reader Service card on p. 17 or 18

Now . . . 7 big improvements for foundrymen from HANNA . . . the best known name in iron . . .

HANNATEN

THE IRON INGOT WITH THE NEW SHAPE

For users of 10-lb. pigs

AVAILABLE IN ALL GRADES AND EXTRA-CLOSE-GRAIN HANNATITE. (STANDARD 38-POUND PIGS ALSO AVAILABLE.)

THE HANNA FURNACE CORPORATION

Buffalo • Detroit • New York • Philadelphia

Merchant Pig Iron Division of

NATIONAL STEEL CORPORATION

For more facts, circle No. 523 on postage-free Reader Service card on p. 17 or 18

NORTHERN CALIFORNIA . . John G. Campbell, left, Pacific Steel Castings Co., chapter reporter, with guest speaker George E. Miller, Machine Div., Federal Foundry Supply Co., at the April meeting.

the Engineers Club on January 28, February 25 and March 25, 1955. Discussion leaders were Harold Kurtz, Empires Steel Casting Co.; Robert Mason, Treadwell Engineering Co., and Edward H. Berry, Dodge Steel Co.—*Charles R. Sweeny.*

Timberline

The April meeting was held at the Oxford Hotel, Denver, Col., with approximately 40 members and guests attending. Byron McPherson, McPherson Corp., presided and technical chairman for the evening was W. R. Manske, American Manganese Steel Div.

Two films were shown, *"The Steel With 1000 Qualities,"* and a film by U. S. Steel Corp., presented by W. N. Chivis. Curtis Drake, chairman of the Nomination Committee presented a slate of officers for the coming year to be elected at the next regular meeting.—*A. D. Neal.*

Metropolitan

The April meeting was held at the Essex House, Newark, N. J. More than 150 members and guests heard Harold Bishop, Naval Research Laboratory, speak on *"Feeding of Castings."*

Mr. Bishop discussed the three major factors influencing casting soundness: proper positioning of feedheads, use of chills and degasification of the melt. The mode of solidification of castings was described and illustrated by schematic drawings, and charts were shown of solidification data secured from studies made on steel, gray iron, bronzes and aluminum alloys.

In discussing risering, Mr. Bishop presented mathematical data covering riser dimensioning, location and feeding range factors, as well as other significant phenomena associated with the effectiveness of feeding, for steel, manganese bronze and ductile cast iron. The use of chills in strategic locations to extend the feeding range of steel risers was discussed and illustrated in detail. The subject of proper degasification as an aid to securing sound castings, particularly through the use of vacuum degassing techniques, was given consideration as well.

Technical chairman of the evening, B. N. Ames, Columbian Bronze Corp., subsequently presided over a spirited and lengthy discussion period. As part of the chapter business of the evening, Chapter Chairman Charles Schwalje, Worthington Corp., presented to the membership the recommendations of the Nominating Committee for the officers, committee chairmen and directors for the coming year.

Tri-State

The April meeting was designated as Apprentice Night. Fifty-eight members and guests met for dinner at the Alvin Hotel, Tulsa, Okla.

George Marsh, Director of Adult Education, Tulsa Public Schools; R. M. Earley, Oklahoma State Supervisor, Bureau of Apprenticeship, U. S. Dept. of Labor, and J. Bennett Jones, Eastern Oklahoma Apprenticeship Representative, Bureau of Apprenticeship, U. S. Dept. of Labor, were guests of the Chapter.

Each of 18 apprentices were introduced to the group and a film on Lebanon Steel Castings Co., concluded the program.

Rex A. Hill, Progressive Brass Mfg. Co., Tulsa, Okla., has been selected to complete the term as a director of the chapter, recently vacated by Phil W. Spooner.—*A. M. Fisher.*

Tennessee

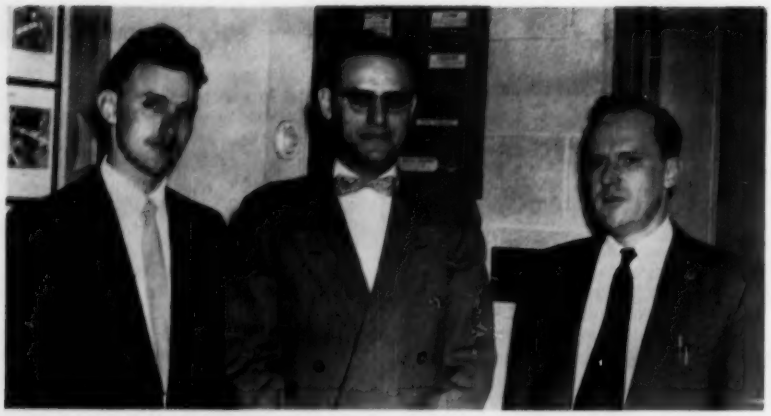
"Your safety program is just like a girl's sweater," according to G. A. Riley, safety director for American Brake Shoe Co., "in that it shows results in proportion to what you put in it." This closing remark by the April speaker just about summed up the impression that approximately 50 Chattanooga area foundrymen had gained

CASTING through the Ages

CLAY taken from ANT hills
WAS USED BY KATANGA CRAFTSMEN OF AFRICA IN MAKING THEIR COPPER MELTING FURNACES.
A MONK RESIDING IN GHENT IS SAID TO HAVE CAST THE FIRST BRONZE GUNS ABOUT 1313 A.D.
LARGE CAST IRON STOVES, ENCLOSED IN BRICK VAULTS, WERE BEING SOLD AS "CENTRAL HEATING PLANTS" AS EARLY AS 1840.
Al Petty

Odd Bits

THE FOUNDERS WHO CAST THE IRON GUNS USED IN 1544 BY HENRY VIII OF ENGLAND AT THE SIEGE OF BOULOGNE WERE PAID, IT IS SAID, AT THE RATE OF 25¢ A POUND FOR THEIR PRODUCT.



UNIVERSITY OF ILLINOIS (Urbana) . . Attending the student chapter Industrial Night meeting in March are, left to right: Robert C. Kay, chairman, student branch, American Institute of Mining & Metallurgical Engineers; Charles Fausel, Central Foundry Div., General Motors Corp., Danville plant; and Dr. Thomas A. Read.

from a discussion on *"Safety in the Foundry"* by Mr. Riley. He was introduced by J. A. Weed, Chattanooga Div., of Brake Shoe.

Paul L. Arnold, U. S. Pipe & Foundry Co., announced the nominating committee's choice for next years officers. Attendance prize was won by Frank Robbins, Robbins & Bohr.—*W. F. Hetzler.*

New England Foundrymen's Assn.

A large crowd gathered at the University Club, Boston, Mass., in April to hear Charles H. Barnett, Foundry Equipment Co., Cleveland, speak on the modernization of the small foundry core room. He used slides to illustrate his talk.

The speaker demonstrated the tremendous change in core baking which has transpired over a period of years—from the old smoky core oven to the clean, bright modern gas or oil fired ovens, which tends to make better and more intricate cores, heavy or light cores being placed at various parts of the oven for better baking, and reducing core baking time and expense.—*Alexander Beck.*

Connecticut Non-Ferrous Foundrymen's

The April meeting was held at the Quinnipack Club, New Haven, Conn., and consisted of panel discussion.

Panel members were: James J. Shannon, Jenkins Bros. Co., Bridgeport, Conn.; James Manzolli, Waterbury Mfg. Co. Div., Chase Brass & Copper Co., Waterbury, Conn.; Curtis Peasley, Peasley Products Co., Stratford, Conn.; George Leask, Stamford Castings Co., Stamford, Conn., and Walter Helmadach, Wilcox-Crittenden & Co., Middletown, Conn. Mr. Hemadach acting as moderator and discussion leader, introduced the panel members and the topics for discussion.

Mr. Shannon spoke on *"Metallurgy and Technical Control,"* and talked about the importance of conforming to government and customer requirements in respect to the chemical and physical properties of alloys. Constant technical and laboratory control of sands, refractories and all alloys and allied materials were emphasized.

"Production Brass Foundry Problems," was the topic of Mr. Manzolli. He related his experience with various production jobs requiring considerable study on gating and the problem of arranging the pouring of light and heavy work at the same time. He touched upon sand specification, foundry equipment employed and upon laboratory facilities for investigating defects and other foundry problems.

A gate of casting which he exhibited showing shifting in different directions was presented for discussion. Several suggestions for solving the problem were given, including sample pouring in a flask for checking equipment alignment if this was a factor in the difficulty.

The second casting presented had a surface defect on the cope side. According to the concensus of opinion, this appeared to be caused by sand wash due to weak sand loosened at the bottom of the sprue which floated to the cope surface side of the casting and resulted in tiny specks.

In answer to a question, Mr. Manzolli mentioned porosity due to moisture and incorrect pouring temperature as the chief causes for rejects.

Mr. Peasley spoke on *"Aluminum Castings."* Aluminum foundry practice is similar to that of the brass foundry except that lower pouring temperatures are employed with some variation in molding and core sands, depending upon the casting design, he said. Some alloys have a high solidification shrinkage and are subject to hot-cracking unless the mold is properly gated. Pouring temperature control and prevention of gas absorption were stressed.

Mr. Leask described the melting of magnesium base alloys in iron pots in his talk on *"Magnesium Castings."* The green molding sand is treated with an inhibitor on account of the action of water vapor upon the hot metal, he pointed out. A number of agents, such a sulphur and boric acid, sometimes in combination with glycol are used as inhibitors. Brass patterns are employed in this operation and the speaker pointed out some differences in gating, also the necessary fluxes in melting.—*Frank B. Diana.*

Reading Foundrymen's Association

Paul K. Reiniger was elected president of the Reading Foundrymen's Association at the May meeting held at the Walnut Room of the Berkshire Hotel, Reading, Pa. He succeeds James Woodward who was elected to the executive committee.

Other officers elected at the dinner meeting, attended by approximately 100 persons, were John W. Swengel, vice-president; Paul C. Holland, treasurer, and William I. Cassidy, secretary.

On the executive committee, besides Mr. Woodward, are Paul B. Harner, Daniel Heckman, George C. Kissell, Robert M. Schumo and James H. Stewart.

William S. Thomas, vice-president of the Emmaus Foundry & Machine Co., Inc., Emmaus, Pa., was the guest speaker at the meeting. His subject was "Shell Molding and Shell Molding Castings."

He said shell molding is the first real technical advancement in the foundry industry in many years. He added that it produces a much finer finish and reduces the cost of cleaning and grinding.

Hermann P. Good announced that the group's annual golf tournament and outing will be held at the Reading Country Club, June 16.—*W. I. Cassidy.*

UNIVERSITY OF ILLINOIS (Urbana) . . Left to right, Thomas Smith, Central Foundry Div., General Motors Corp., Danville; C. J. Turner, Caterpillar Tractor Co., Charles Drury, Central Foundry Div., Saginaw, Mich., and Prof. N. A. Parker, at the March meeting of the student chapter.

ACCURATE

MULTI-CAVITY DUMP BOX

UNIFORM IMPRESSIONS...LOWER COST

The 8 gang dump box shown in this unretouched photograph was made from the single wood master core plug and backing frame. The same method may be used for two part split or booked type core boxes with flat or irregular partings. Added savings plus greater accuracy are assured when properly cleared white metal or aluminum master dryer patterns are also made by this same process.

There is real profit in this idea for you. Hundreds of foundries are now using this modern streamlined method of making core boxes and master dryer patterns because it is accurate, saves machining and offers large savings in the more intricate and gang type core boxes.

QUICK DELIVERY

By Air Freight, Parcel Post, Special Delivery or Railway Express. Pick-up and delivery by jobber representatives in the following areas . . .

AUBURN, MASS.
Henry A. Kottmann
Telephone: Auburn 2683

MILWAUKEE, WIS.
John M. Donohue
Telephone: Hilltop 2-7130

LOS ANGELES, CAILF.
McGowan Company, Inc.
Telephone: Trinity 2057

Write for Catalog

ACCURATE MATCH PLATE COMPANY
1851 WEST CARROLL AVENUE • Telephone: SEeley 3-7918 • CHICAGO 12, ILLINOIS

No Matter What Your SAND Requirements...

Look to WEDRON

- Rounded Grain Sand
- Uniform Screen Sizes
- Ground Sand
- Shell-Molding Sand
- Special Grades For Every Purpose

THERE'S no guesswork with WEDRON sands for foundry use. You can order what you require and be sure that you're getting *exactly* the grade you specify. Each and every shipment is uniformly graded to exacting standards at the WEDRON plants.

Whether you do shell-mold casting, lost wax casting, or any other special type of foundry work, you can get the sand you need from WEDRON. The finest silica sands in America are mined in the Ottawa-Wedron region of Illinois where all of WEDRON'S sands are produced.

See WEDRON about your next sand requirements!

MINES AND MILLS IN THE OTTAWA WEDRON DISTRICT

WEDRON SILICA COMPANY

135 S. LA SALLE ST. CHICAGO 3, ILL.

For more facts, circle No. 550 p. 17-18

Chapter Meetings

June

2 . . Saginaw Valley
Annual Outing

11 . . Toledo
Adams Conservation Club. Annual Outing.

11 . . Northern Illinois—Southern Wisconsin
Beloit Country Club, Beloit, Wis. Annual Outing.

11 . . Washington
Elks Temple, Bremerton, Wash. Ladies Night.

11 . . Central Michigan
Coldwater Country Club. Annual Outing.

14 . . Cincinnati
Elks Country Club, Hamilton, Ohio. Annual Golf Party and Outing.

18 . . Western New York
Depew Grove, Depew, N. Y. Annual Outing.

18 . . Quad City
Annual Outing.

25 . . Northeastern Ohio
Twin Lakes Country Club. Annual Outing.

MAN FROM SEATTLE

A cocky new helper came into the shop
Who talked just to hear his head rattle.
"I'm not exactly a greenhorn," he bragged;
"I ain't spent my life punching cattle.
I'm a molding fool of the old, old school.
I worked in a shop in Seattle."

He would look at a mold with a fishy-eyed stare.
How we hated his asinine prattle!
His critical gaze, his superior ways.
With that guy we'd like to do battle!
Saying, "That might be OK but it sure ain't the way
We did it up in Seattle."

When we told him this shop always put out good work,
This mug replied, "Fiddle-faddle!"
"If I was outfitting a row boat,
This joint couldn't make me a paddle!
If you think that this shop is close to the top
You should see that shop in Seattle!"

"Everything in the foundry's efficient and smooth;
We don't have the bang and the rattle.
Mechanical riddle, a sand slinger, too,
In that big, modern shop in Seattle.
Big bonus each year, and they hand out free beer
In that wonderful shop in Seattle!"

At last we took up a collection
And purchased a horse and a saddle,
We grabbed this fool from the old, old school,
We hoisted him, set him a-straddle,
And gave him a slap on the back of the lap,
And the nag bolted off for Seattle!

From *Rammed up and Poured* by Bill Watkins.

Produce More Top Quality Castings with Top Quality FOUNDRY MATERIALS

Use these Time-Tested Products for Best Results

SAND
Portage (Wis.) Silica
Century Molding
* Ottawa Blackhawk Silica
Muskegon Lakesand
Tenn. & Ind. Molding
Utica Crude Silica
Silka Molding
* Zircon Sand, Flour and Wash
Berlin Coresand
Red Flint Annealing
New Jersey Molding
Gallia Red Molding
Albany Molding

BONDING CLAYS
* Volclay, MX-80 (Granular)
* and Panther Creek Bentonite
* Goose Lake Fire Clay
* Grundite Bonding Clay

ABRASIVES
Tru-Steel Steel Shot
* Malleabrasive Shot and Grit
* Certified Shot and Grit
* Blackhawk Sand Blast Sand
* Super-Titan Nozzles

REFRACTORIES & MISC.
Cargan Cupola Gun Mix
Firegan Ganister
* Microsil Silica Flour
Fluxing Limestone
* Five Star Wood Flour
* Sultron Foundry Flux
Fluorspar—Lump & Gravel
Wood—Slabs & Edgings
* Whse. Stocks carried

CARPENTER BROTHERS INCORPORATED
Main Office: 606 W. Wisconsin Ave.
MILWAUKEE 3, WIS.
Tel. BRoadway 6-0140
BRANCH OFFICES

ST. PAUL, 5
1803 Princeton Ave.
Tel. EMerson 6312

MUSKEGON
1209 Moulton St.
Tel. 4-7248

For more facts, circle No. 541 p. 17-18

Ohio Ferro-Alloys Corporation
Canton, Ohio

SALES OFFICES
CHICAGO · PITTSBURGH · SEATTLE
MINNEAPOLIS · DENVER · DETROIT
TACOMA · MEXICO CITY · BIRMINGHAM
SAN FRANCISCO · LOS ANGELES

PLANTS AT
PHILO, OHIO
TACOMA, WASHINGTON
BRILLIANT, OHIO

MANGANESE PRODUCTS TO SERVE YOUR NEEDS

HIGH CARBON FERRO-MANGANESE — 74-76% & 78-80% MN, 7% C.

SILICO MANGANESE — 65-68% MN, C. GRADES MAX. 1.50, 2.00 & 3.00

MEDIUM CARBON FERRO-MANGANESE — 80-82% MN, 1.50 MAX. C.

FERRO-MANGANESE BRIQUETS
2 LBS. CONTAINED MN. EACH

SILICO-MANGANESE BRIQUETS
2 LBS. CONTAINED MN. & ½
LB. CONTAINED SI EACH.

Ohio Ferro-Alloys Corporation
Sales Department

Classified Advertising

For Sale, Help Wanted, Personals, Engineering Service, etc., set solid..20c per word, 30 words ($6.00) minimum, prepaid **Positions Wanted** ..10c per word, 30 words ($3.00) minimum, prepaid. Box number, care of *American Foundryman*, counts as 10 additional words.

Display Classified..Based on per-column width, per inch..1-time, $15.00; 3-time, $13.50 per insertion; 6-time, $12.50 per insertion; 12-time, $12.00 per insertion; prepaid.

HELP WANTED

ALUMINUM CASTING ENGINEER. If you are interested in joining a Chicago foundry organization that is ambitious, aggressive and definitely expanding its facilities, and if you have had experience in foundry engineering on aircraft quality aluminum castings, we would like to hear from you. Please submit a brief résumé. Salary will depend upon qualifications. All replies will be held in strict confidence. **Box C37. AMERICAN FOUNDRYMAN, Golf and Wolf Roads, Des Plaines, Ill.**

METALLURGIST. Experienced in cast iron and foundry practice. Prepared to travel. State salary required and full qualifications. **Box C36, AMERICAN FOUNDRYMAN, Golf and Wolf Roads, Des Plaines, Ill.**

If you have a thorough knowledge of rigging core boxes for core blowing and like to travel, you may qualify as **Field Service Representative** for a large foundry equipment manufacturer. Some engineering experience would be desirable. Apply in writing, stating qualifications. **Box C40, AMERICAN FOUNDRYMAN, Golf and Wolf Roads, Des Plaines, Ill.**

PLANT MANAGER

Experienced plant manager for small progressive alloy steel foundry in Michigan. Technical background preferred, but not necessary. Splendid connection for right man.

Box C38, AMERICAN FOUNDRYMAN Golf and Wolf Roads, Des Plaines, Ill.

PROJECT ENGINEER. Specialized gray iron foundry Mid-Ohio city of about 80,000 population. Various non-repetitive production problems including research and development under supervision of Vice-President. Recent graduate foundry option Industrial Engineer with some shop experience. Replies confidential. Write full details personal background, resume of experience, references and salary expected. **Address Box C35, AMERICAN FOUNDRYMAN, Golf and Wolf Roads, Des Plaines, Ill.**

GRINDING FOREMAN. Midwest foundry. State qualifications, references and salary. **Box C42, AMERICAN FOUNDRYMAN, Golf and Wolf Roads, Des Plaines, Ill.**

SHELL MOLD SUPERVISOR

Must have considerable practical experience in all phases of shell molding as an operator and a supervisor. Will accept man with working experience in place of technical background. To head new department. Excellent starting salary, good advancement potentials. Give age, salary requirement, complete résumé of experience and past employment. All replies confidential.

Box C39
AMERICAN FOUNDRYMAN,
Golf and Wolf Roads
Des Plaines, Ill.

FOR SALE

USED MOLDING MACHINES
FOR SALE
SPO AND OSBORN
PRICED TO SELL
THE FOREST CITY FOUNDRIES COMPANY
2500 West 27th St.
Cleveland, Ohio

FURNACES FOR SALE

10 used Heat Treating Furnaces, and two 7-ton gantry cranes, good condition, priced to sell.
BAER STEEL PRODUCTS, INC.
Box 1428
Boise, Idaho

ENGINEERING SERVICE

EARL E. WOODLIFF,

Foundry Sand Engineer.
Consulting . . . Testing.
14611 Fenkell (5-Mile Rd.) Detroit 27, Mich.
Res. Phone Vermont 5-8724

SESSIONS ENGINEERING CO.

Consulting Foundry Engineers
Modernization, Processing Layouts
Cost Reduction Quality Control
Product — Machine Design
Architectural Design

One North La Salle St. Chicago 2, Ill.

POSITIONS WANTED

GENERAL MANAGER OR ADMINISTRATIVE ASSISTANT. Experienced nonferrous general manager available as administrator or assistant. Operated nonferrous foundry, machine shop, pattern shop, heat-treat. Technical work in Iron and Steel. Doing general industrial consulting. Good sales, operating, labor negotiation, technical record. Age 47. Engineer. Native midwest. Willing to relocate. **Reply to Box C34, AMERICAN FOUNDRYMAN, Golf and Wolf Roads, Des Plaines, Ill.**

Manager or Plant Superintendent (Canada) experienced in all phases of foundry operation and management. 20 years' gray iron experience, including pattern shop, machine shop, enameling plant, plant layout, design, cost, quality control, time-study, purchasing and sales. Qualified to assume high responsibility. Looking for a greater opportunity. Presently employed in this capacity. **Address Box 41, AMERICAN FOUNDRYMAN, Golf and Wolf Roads, Des Plaines, Ill.**

Free Tear Sheets

of all AMERICAN FOUNDRYMAN articles are available on request. Keep your magazine intact and pass it on for others to use. For free tear sheets, write to Editor, AMERICAN FOUNDRYMAN, Golf & Wolf Roads, Des Plaines, Ill. Please show company connection and your title on tear sheet request.

Obituaries

Robert C. Woodward, 68, retired chief metallurgist for Bucyrus-Erie Co., Milwaukee, died April 20 at Columbia Hospital after a short illness. Mr. Woodward was associated with Bucyrus-Erie from 1935 until retiring last December. He was named chief metallurgist in 1946. Before

R. C. Woodward

joining Bucyrus-Erie he was chief metallurgist for National Brake & Electric Co., Milwaukee, a subsidiary of Westinghouse Air Brake Co., and was superintendent of the George H. Smith Steel Casting Co., Milwaukee. Mr. Woodward was born in North Syracuse, N. Y., and was graduated from Stanford University, Palo Alto, Calif., in 1911. He was a past chairman of the Wisconsin Chapter of AFS and a member of the American Society for Metals and the American Society for Testing Material.

Award Honors Tom Makemson

Memorial to the late Tom Makemson, longtime secretary of the Institute of British Foundrymen, is being established by I.B.F. To be set up with funds now being solicited, the memorial will take the form of an annual award of a Tom Makemson Bronze Medal and Prize to the best student in the final patternmaking examination of the City and Guilds of London Institute. Throughout his life, Mr. Makemson maintained a keen interest in students, and participated in the organization of the City and Guilds examinations in patternmaking from their inception.

Mr. Makemson, well known to many foundrymen in Europe and North America, attended several conventions of the American Foundrymen's Society, including the 1952 International Foundry Congress in Atlantic City. He served for a number of years as secretary of the International Committee of Foundry Technical Associations.

Contributions to the Tom Makemson Memorial should be sent to: Institute of British Foundrymen, St. John Street Chambers, Deansgate, Manchester 3, England.

1956 International Foundry Congress to be in Germany

Invitation of the German Foundrymen's Association to act as host for an International Foundry Congress at Düsselfdorf, Germany, in 1956 has been accepted by the International Committee of Foundry Technical Associations. An International Foundry Fair will be held in conjunction with the Congress.

The International Committee is made up of representatives of societies of 12 countries and includes the American Foundrymen's Society. Three International Congresses have been held in the United States: Atlantic City in 1952, Philadelphia in 1934, and Detroit in 1926.

This year, the International Foundry Congress is being held in London, England, June 20-26 under the auspices of the Institute of British Foundrymen.

Issue Castings Defects Book

Pocket-size (5x 7 in.) book on casting defects has been issued by the foundry division of the Federation of Swedish Mechanical Engineering Industries in Stockholm. Listing 59 specific defects classified according to 13 types, the *Little Handbook on Defects in Castings* gives not only pictures but also sketches which graphically portray the defect or what caused it.

Price of the handbook is 9 kr ($2.00). Copies can be obtained by writing to Sveriges Mekanförbund, Gjuteriavdelningen, Karlavägen 43, Stockholm, Sweden.

"OLIVER" BAND SAW

takes 35" under guide to saw extra large patterns

This new "Oliver" is powerful and sturdy. Gives clearance for sawing large patterns, jigs and fixtures. Has 36" diameter wheels. Cuts true and steady without vibration at all speeds. Motor-on-shaft unit, and latest features.

Write for Bulletin No. 116-DH

OLIVER MACHINERY COMPANY
Grand Rapids 2, Mich.
For more facts, circle No. 547 p. 17-18

USING TOO MUCH COKE?

Why not talk this over with one of our metallurgists with a view to taking advantage of the superior quality of Semet-Solvay Foundry Coke in reducing your melting costs.

SEMET-SOLVAY DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 Rector Street — *New York 6, N. Y.*
Buffalo • Cincinnati — Cleveland • Detroit
In Canada: SEMET-SOLVAY COMPANY, LTD., Toronto
Western Distributor: WILSON & GEO. MEYER & CO., San Francisco

For Better Melting

For more facts, circle No. 548 on postage-free Reader Service card on p. 17 or 18

Advertisers and their Agencies

Accurate Match Plate Co. 125
Agency—Vernon S. Weiler Adv.

Allis-Chalmers Mfg. Co., General Machinery Div. 21
Agency—Compton Advertising, Inc.

American Colloid Co. 16
Agency—Robert A. Gallagher Adv.

American Wheelabrator & Equipment Corp. 33
Agency—The Jaqua Co.

Apex Smelting Co. ..... Back Cover
Agency—Doremus & Co.

Archer-Daniels-Midland Co. ..... Inside Back Cover
Agency—Bayless-Kerr Co.

Baird Associates, Inc. 45
Agency—Molesworth Associates

Baroid Division, National Lead Co. 42
Agency—Rittenhouse & Co.

Beardsley & Piper, Div. Pettibone Mulliken Corp. 40-41
Agency—Ladd, Southward, Gordon & Donald, Inc.

Bell, M. A., Co. 120
Agency—Gordon Gerber

Buehler Ltd. 103
Agency—Kreicker & Meloan, Inc.

Carl Mayer Corp. 130
Agency—Wellman, Buschman & Hines, Inc.

Carpenter Bros., Inc. 126
Agency—Irving G. Rahn, Adv. Agency

Christiansen Corp. 107
Agency—Marsteller, Rickard, Gebhardt and Reed, Inc.

City Pattern Foundry & Machine Co. 8
Agency—Gray & Kilgore, Inc.

Cleveland Flux Co. 28-29
Agency—Brad Wright Smith Adv., Inc.

Delta Oil Products Co. 30
Agency—Cormack, Imse, Beaumont, Inc.

Eastern Clay Products Dept., International Minerals & Chemical Corp. 25
Agency—C. Franklin Brown, Inc.

Electro Metallurgical Co., A Division of Union Carbide & Carbon Corp. 38
Agency—J. M. Mathes, Inc., Adv.

Federal Foundry Supply Co. 1
Agency—Kasper Advertising

Foundry Equipment Co. 96-97
Agency—Allied Advertising Agency, Inc.

Foundry Rubber, Inc. 118
Agency—Kenneth T. Champness Adv.

General Electric Co., Chemical Div. 105
Agency—Benton & Bowles, Inc.

Gray Iron Founders' Society, Inc. 31
Agency—Fuller & Smith & Ross, Inc.

Grindle Corp. 4
Agency—Terry Koeller Associates

Hanna Furnace Corp. (Div. National Steel Corp.) 122
Agency—Campbell-Ewald Co.

Hickman, Williams & Co., Inc. 22
Agency—Saas and Sogard, Inc.

Illinois Clay Products Co. 11
Agency—Waldie & Briggs, Inc.

International Minerals & Chemical Corp., Eastern Clay Products Dept. 25

Keokuk Electro-Metals Co. 19
Agency—Waldie & Briggs, Inc.

Kinney Mfg. Div., New York Air Brake Co. 119
Agency—Hammond-Goff Co.

Lindberg Engineering Co., Fisher Furnace Div. 131
Agency—Saunders, Shrout & Associates, Inc.

Link-Belt Co. 15
Agency—Klau-Van Pietersom-Dunlap, Assoc.

Louthan Mfg. Co. (Subsidiary Ferro Corp.) 26
Agency—Fuller & Smith & Ross, Inc.

Magnaflux Corp. 39
Agency—Glenn, Jordon, Stoetzel, Inc.

Monsanto Chemical Co. 23
Agency—Needham, Louis, & Brorby, Inc.

Manhattan Rubber Div. Raybestos-Manhattan, Inc. 98
Agency—Roland G. E. Ullman Org.

National Engineering Co. 116-117
Agency—Russell T. Gray, Inc.

National Metal Abrasive Co. 22

Newaygo Engineering Co. 132
Agency—The Jaqua Co.

Nugent Sand Co. 24
Agency—Klau-Van Pietersom-Dunlap, Inc.

Ohio Ferro-Alloys Corp. 127
Agency—Huffman and Broadwater, Inc.

Oliver Machinery Co. 129
Agency—Webb J. Van Dyke Adv.

Orefraction Inc. 27
Agency—Smith, Taylor & Jenkins, Inc.

Pangborn Corp., Blast Cleaning Div. 9
Agency—Van Sant, Dugdale & Co., Inc.

Pangborn Corp., Malleabrasive Div. 13
Agency—Van Sant, Dugdale & Co., Inc.

Pittsburgh Lectromelt Furnace Corp. ..... Inside Front Cover
Agency— Fuller & Smith & Ross, Inc.

Raybestos-Manhattan, Inc. Manhattan Rubber Div. 98

Royer Foundry & Machine Co. 14
Agency—Advertising Producers Associated, Inc.

Schneible, Claude B., Co. 115
Agency—Jackson Studios

Semet-Solvay Div., Allied Chemical & Dye Corp. 129

Simplicity Engineering Co. 109
Agency—Price, Tanner & Willox, Inc.

Stevens, Frederic B., Inc. 2
Agency—Zarker Adv. Co.

Sutter Products Co. 35-36
Agency—Gray & Kilgore, Inc.

Union Carbide and Carbon Corp. Electro Metallurgical Co. 38

Vanadium Corp. of America 37
Agency—Hazard Advertising Corp.

Welsh Refractories Corp. 121
Agency—Ralph Smith Adv. Agency

Wedron Silica Co. 126
Agency—Armstrong Adv. Agency

Whiting Corp. 7
Agency—Waldie & Briggs, Inc.

This index is published as a convenience to the readers. While every care is taken to make it accurate AMERICAN FOUNDRYMAN assumes no responsibility for errors or omissions.

2000° F TEMPERATURE RANGE HEAT-TREAT FURNACE

engineered and installed by carl mayer

Here is one of the outstanding heat-treat furnace installations blueprinted by Carl Mayer to fit a given requirement.

This recirculating, gas-fired, car bottom type at the Golden Foundry Co., Columbus, Ind., was engineered to meet a high temperature range requirement. It has proven an asset to the production of cast iron engine blocks.

Write for bulletin HT-53. Over 30 years' experience.

THE carl mayer CORP.

3030 EUCLID AVENUE • CLEVELAND 15, OHIO

OTHER PRODUCTS: Core & Mold Ovens • Rod Bakers • Paint & Ceramic Drying Ovens • Special Processing Equipment & Accessories

For more facts, circle No. 542 on card on p. 17 or 18

Non-Ferrous Annual Meeting

Continued from page 68

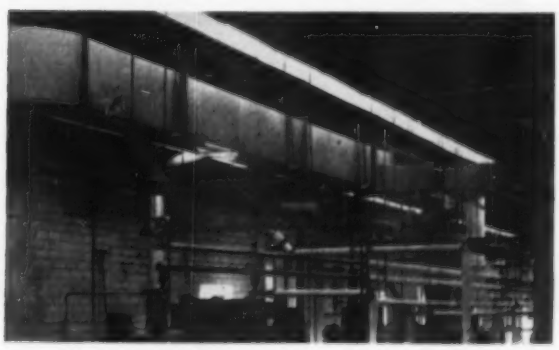
according to William A. Meissner, Jr., deputy director, Copper Div., Business and Defense Services Administration. In his talk, he gave as reasons for his outlook: (1) an 18 per cent increase in shipments of brass and bronze castings by foundries in March as compared with February; (2) a slight increase in military requirements for the third quarter of 1955; and (3) general increase in consumer sales.

The dinner and dance concluding the annual meeting were highlighted by presentation of plaques honoring the original board of N.F.F.S. and announcement of officers and directors for the coming year. Founding directors cited were: Thomas Addie, Philadelphia; Harry Burgin, Philadelphia; A. M. Cadman, Pittsburgh, Pa.; Justin A. Duncan, Boston; Fred J. Eberhardt, Chicago; Chester K. Faunt, Chicago; Louis Fischer, Dunellen, N. J.; James F. Gilbert, St. Louis; George B. Hazen, Peoria, Ill.; Edwin W. Horlebein, Baltimore, Md.; Walter W. Hunter, Chicago; Roy M. Jacobs, Milwaukee; Fred A. Mainzer, San Francisco; Albert Meskan, Chicago; L. M. Nesselbush, Lowellville, Ohio; and three deceased members of the original board—William L. Paulson, Brooklyn, N. Y.; Charles H. Stokesbury, Derby, Conn.; and Oscar W. Swangren, Boston.

Officers for the coming year will be: president, William L. Leopold; first vice-president, Edward J. Metzger; and second vice-president, Charles J. Egetter, Crown Brass Mfg. Co., Los Angeles, James W. Wolfe continues as executive secretary and secretary-treasurer.

Incoming directors are: James H. Brennan, Pittsburgh Brass Mfg. Co., Pittsburgh, Pa; William W. Dyer, Trinity Brass & Copper Co., Dallas, Texas; George T. Fischer, Fischer Casting Co., Dunellen, N. J.; Phillip E. Lankford, East Birmingham, Bronze Foundry Co., Birmingham, Ala.; Wm. L. Leopold; Albert J. Messmer, Messmer Brass Co., St. Louis; and R. W. Sweitzer, I. S. Spenser's Sons, Guilford, Conn.

The Chicago Chapter of N.F.F.S. was host to meeting attendants at a reception prior to the dinner.



Here's How **Cleveland Graphite Bronze Co., Cleveland, used ventilating ducts made of Seiberling Rubber Co.'s new plastic material, Seilon, to carry away deadly acid fumes from plating tanks. Seilon, a rigid polyvinyl chloride, can be used for this and other jobs calling for a corrosion resisting material.** ***Seiberling Rubber Co.***

New From Lindberg-Fisher

For Permanent Mold and Sand Casting of Aluminum, Magnesium, Zinc and Lead.

A Lindberg-Fisher Electric Resistance Melting Furnace can mean lower cost per lb. of finished casting.

These furnaces eliminate localized heating of metal, eliminate gas absorption, because there are no products of combustion present. Higher production results, due to less operator fatigue. Exhaust fumes and smoke are nonexistent and radiation loss is held to an absolute minimum by use of high quality insulation.

Longer crucible or pot service and low furnace maintenance are obtained with the patented long life, low voltage elements.

Can also be used as a holding furnace on die casting applications.

Write for Bulletin No. 320

LINDBERG FISHER **MELTING FURNACES**
A Division of Lindberg Engineering Company

2440 WEST HUBBARD STREET, CHICAGO 12, ILLINOIS

The SUPER HANDY SANDY

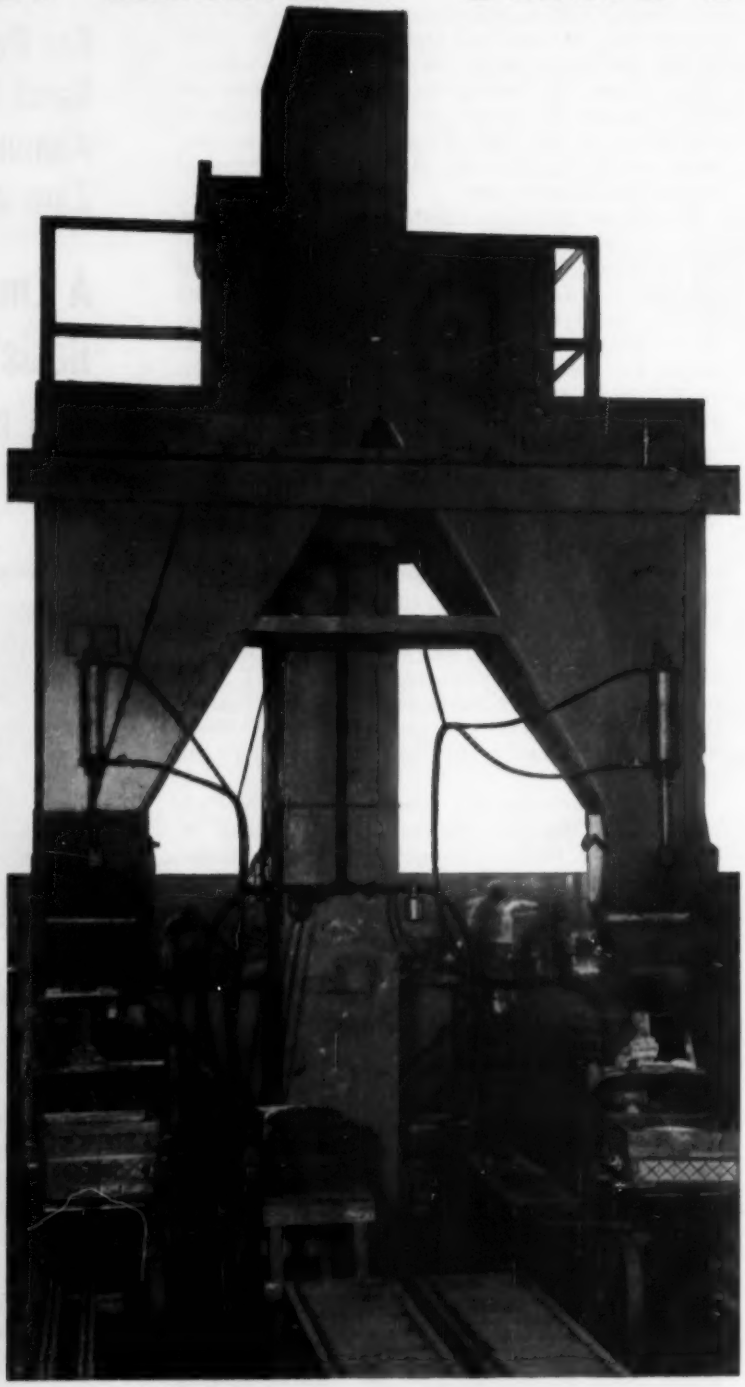
A HIGH CAPACITY INDIVIDUAL-FLOOR SAND HANDLING UNIT

fills large flasks in seconds—
that before took several man hours

This unit can handle up to 50 tons of sand per hour into overhead hoppers where it is available to the molders without effort. Super Handy Sandy's big sand capacity makes it ideally suited for use with large molding machines such as rollover machines, bumpers, and automatic molding machines.

The savings possible through use of the Super Handy Sandy are almost unbelievable. In one installation mold production on large molds has been increased 150% due to savings in shovel time alone. One molder can fill more molds than several men with shovels. He merely operates an air valve and the sand falls into the flask. Thus he spends more time making molds and less time getting ready.

Two Single Hopper Super Handy Sandys with a common feed hopper supplying both units.



NEWAYGO engineering company
NEWAYGO, MICHIGAN

For more facts, circle No. 533 on postage-free Reader Service card on p. 17 or 18

℞

Tonic for Casting Ailments...

Troubles vanish when you put ADM foundry products to work in your foundry.
You improve casting quality, reduce core-room costs and foundry rejects.

It pays to see your LINOIL man at least twice a year for diagnosis of core problems.

FOR HEALTHY CASTINGS...PRESCRIBE ADM PRODUCTS...

Archer-Daniels-Midland company

FOUNDRY PRODUCTS DIVISION • 2191 WEST 110th STREET, CLEVELAND 2, OHIO

Outstanding Machinability . . . All-Purpose Economy

APEX Z-33 ALUMINUM ALLOY

A quality all-purpose alloy that gives you outstanding economy on the production line—that's Apex Z-33. Developed by Apex to combine better than average mechanical properties, uniform casting characteristics and exceptional machinability, Z-33 has been thoroughly proved in both foundry and final application. Its as-cast properties are right for most castings, it can be heat treated for highly stressed castings, and it has excellent dimensional stability with an aging treatment. Apex Z-33 takes anodizing and other chemical and electrochemical finishes, responds beautifully to buffing and polishing.

In your profit-minded operation there's a definite place for the versatile, economical applications of Apex Z-33.

Send without obligation for information covering complete specifications and properties of Apex Z-33.

APEX SMELTING COMPANY

CHICAGO • CLEVELAND • LOS ANGELES